ICORHESTECH 2024
Vol. 1, No. 1, 2024, pp. 98~109
Journal Homepage: https://journal.ibrahimy.ac.id/index.php/icorhestech

Website-based Cooperation Agreement Monitoring Information System with Firebase Integration

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ABSTRACT

Information systems have become core in managing business activities. Cooperation agreements, as an essential element in organizations, require efficient management to ensure the continuity of successful cooperation. Although there are already information systems in use, there are still challenges related to coordination, evaluation, and tracking of cooperation agreements. Therefore, this research aims to integrate Firebase technology into the cooperation agreement monitoring information system. By utilizing Firebase features such as Authentication, real-time database, and hosting, this system will also be connected to notifications via email and WhatsApp API to provide information about the status of the agreement submission. The development of this system uses the waterfall method and UML diagrams. The diagrams used are use case diagrams, activity, and class diagrams. Actors involved in this system are partners, admins, visitors, and office heads. Implementing the system developed using Firebase integration facilitates the process of submitting, monitoring, and evaluating cooperation and application development.

Keywords:

Information System; Cooperation Agreement; Firebase; Monitoring; UML

INTRODUCTION

In the current digital era, information systems have become a crucial element in managing various activities. The existence of information systems brings many benefits, such as accelerating business processes, increasing efficiency and accuracy, expanding information coverage, facilitating collaboration, and so on (Salma Nada Safira, 2021). All fields have effectively used technology, including in monitoring cooperation agreements, which is considered very beneficial in the process (Marsuyitno et al., 2020). Collaboration agreements are essential documents in various types of organizations or business entities that require efficient monitoring and management. Collaboration refers to the collaboration of two or more people who work together in a coordinated or complementary manner to achieve specific goals, which can produce greater or more effective results than if done individually (Yusniah et al., 2023)vvperpus. Handling the cooperation agreement documents correctly will ensure satisfaction for the individuals or institutions concerned. A web-based collaboration management system, which records activities from the collaboration application process collaboration control to storing documents resulting from collaboration agreements and reporting, provides excellent benefits to agencies (Artaye et al., 2022). Information systems also optimize the process of storing and searching vendor collaboration data, which was previously limited to physical documentation (Muslihudin & Oktafianto, 2020). A fast and accurate information system can help a decision (Muhasshanah & Qamariyah, 2021). Management of cooperation agreements can be done from various locations and at any time via Internet access without requiring a lot of storage space (Rahim & Selao, 2023). Output or reports from the use of the cooperation agreement monitoring information system include the ability to print or export data into various formats such as PDF, Word, CSV, and Excel for other needs (Kusdwiadji & Budisaputro, 2021).

This research was conducted at a government institution in one of the districts in East Java which has implemented a cooperation agreement information system. The use of this system provides several advantages for the institution. This system displays information regarding collaboration applications and details of existing collaborations. However, there are still challenges and weaknesses associated with existing systems. The challenges faced include a lack of media for coordination and monitoring of collaboration between partners or related departments through available systems, a lack of systematic,

integrated evaluation of collaboration to assess the sustainability of the collaboration, and a lack of notification and tracking regarding approval or rejection of collaboration.

In an effort to overcome these challenges, a more modern and efficient approach is needed. One solution is to integrate Firebase technology into a website-based cooperation agreement monitoring information system. Firebase, as a mobile and web application development platform managed by Google (Kurniawan et al., 2021), offers various features that can increase efficiency and accuracy in monitoring collaboration agreements. These include Firebase Authentication, Firebase Realtime Database, and Firebase Cloud Messaging etc. (Rosyana Fitria Purnomo, Onno W. Purbo, 20221). Through the integration of Firebase services, applications can increase the efficiency and simplicity of transaction processes (Andrianto & Munandar, 2022). The implementation of the Firebase Realtime Database makes it possible to monitor progress independently in real time and routinely (Setyawan, 2024). An application that uses the Firebase real-time database to store data, which focuses on mobile-based reminders of class schedules and student assignments, provides an effective solution for students in dealing with situations where they often miss or forget important information such as class schedules and assignment deadlines (Irawan & Utami, 2023). The use of Firebase Authentication in other research allows storing user identities securely in the cloud. Firebase Authentication can strengthen the authentication system by simplifying the login and user account registration process through authentication for various platforms such as Google, Twitter, Facebook, Github, and other services (Sania Febriani & Fitri Purwaningtias, 2022). In other research, the Firebase Realtime Database is used, which is a NoSQL database that is hosted in the cloud and can store data directly between users. Data is stored in JSON format and automatically synchronized in real time to all users connected to Firebase (Ibnu Faqih et al., 2023). Firebase can also help developers add new features more quickly. This platform provides various libraries for various client platforms, such as Android, iOS, JavaScript, Java, Objective-C, and Node.js, thereby enabling smooth integration with these applications (Alda et al., 2023).

From previous research that has been reviewed, researchers will develop a system that integrates Firebase in a website-based cooperation agreement monitoring system. The implementation of Firebase is expected to simplify the collaboration monitoring process and increase the ease of use of the application. By utilizing the Firebase Authentication, Realtime Database, Firebase Hosting, and Cloud Storage features, a platform can be created that can provide more accurate monitoring of collaboration agreements, as well as increase productivity and efficiency in managing these agreements. This system will not only depend on Firebase but will also be connected to the notification feature via email and the WhatsApp API. Its purpose is to provide notifications about the status of an application, whether it is accepted or rejected, and also to track the progress of the application.

THEORETICAL BASIS

System

A system is a collection of interrelated elements that work together to achieve specific goals (Dr. Ir. Suradi, ST., 2022). It consists of input, processing, and output. To understand a system, it is essential to understand each element that makes it up. Information is data or facts that are arranged systematically, have value, or provide understanding. An information system is explained as a unity of physical and non-physical subsystems that work together in harmony to process data into useful information.

Firebase

Firebase is a Backend as a Service (BaaS) platform owned by Google. This platform is designed to make the work of application developers easier (Musdalifa et al., 2020). Firebase Analytics is an effective way to measure user behavior by analyzing activity over time. The reporting system uses Google technology for easy-to-understand reports with data charts and metrics (Risqi & Herlambang, 2023). Firebase Authentication is a service provided by Firebase to make it easier for developers to implement user authentication systems in their applications. Firebase Authentication offers APIs to manage the authentication process, including new user registration, login, logout, and password reset. This helps maintain application security and improves user experience. Firebase Realtime Database is a cloud database service provided by Firebase. It allows developers to store and synchronize data in real time between users and their applications across all devices (Rosyana Fitria Purnomo, Onno W. Purbo, 20221)v.

Cooperation

Collaboration is an essential factor in developing a manager's duties to achieve organizational goals. This is a business strategy in which two or more parties work together with the same interests and awareness to achieve common goals within a specific period (Muslihudin & Oktafianto, 2020). This involves sharing resources, ideas, and responsibilities to achieve desired results.

Reporting

Reporting is a series of procedures that come together to achieve specific goals or activities by conveying information either verbally or in writing. The type of information conveyed in reporting can vary, including news, information, notifications, or accountability, according to existing needs.

Scheduling

Scheduling is an activity that every person must have in order to help them carry out their daily activities. Moreover, the Regional Government has an agenda of essential activities that must be completed regularly and neatly. This scheduling is so important so that activities can run according to what has been planned (Informasi et al., 2021).

WhatsApp API

WhatsApp Gateway is an API Gateway service that allows communication via WhatsApp and SMS. This service helps users grow their businesses with easy integration, including notification features and reminders. By using this service, users can more easily manage their business via API, which requires an API key to connect (Al Imron et al., 2023).

METHOD

The research method explains the stages that will be carried out during the research process. It is divided into two stages: data collection techniques and system development models.

Data Collection Techniques

The data collection methods used to obtain information related to this research are as follows:

1. Observation
   Retrieve the necessary data by conducting direct research on the object to be studied, namely, conducting direct observations of the object being studied to obtain an overview related to the research.
2. Interview
   Conduct direct interviews with administrative staff in the Banyuwangi government regarding the process and mechanisms for implementing collaboration, from planning to monitoring and evaluation, and who is involved in the entire process.
3. Documentation Study
   The study was carried out by studying literature related to research in books and scientific journals.

System Development Model

The waterfall method works on a system that is carried out sequentially or linearly. The waterfall method is a type of application development model that emphasizes sequential and systematic phases (Rumetna et al., 2022). The development model can be described as a waterfall, where each stage is carried out sequentially from top to bottom (Nur Wachid Hidayatulloh et al., 2023). So that the quality of the resulting system will be good and the system development data or documents are organized. The development of the waterfall method has several sequential stages, first analyzing system requirements, design, coding, and testing.

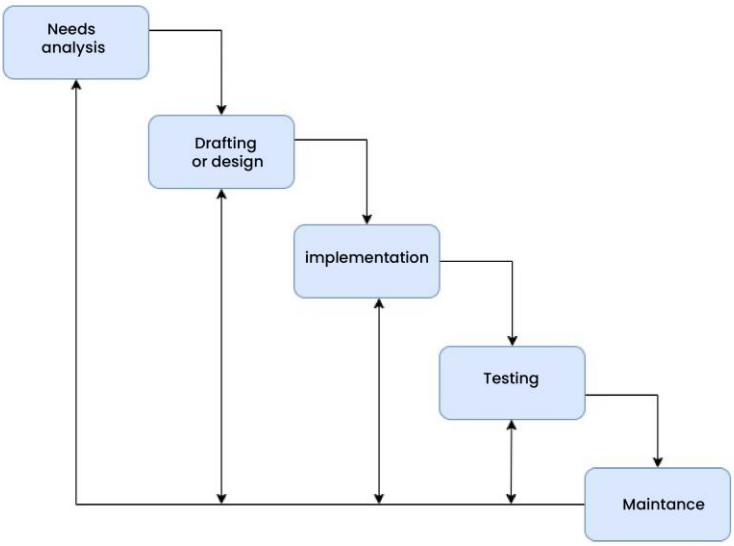

Figure 1: Waterfall System Development Method

1. Needs Analysis (Requirements Analysis)
   This stage involves gathering information and a deep understanding of the needs of users and stakeholders. The goal is to identify the needs that must be met by the software to be developed. The author does several necessary things: interviews, document analysis, and relevant reports, as well as cooperation submission activities and monitoring.
2. Design
   The design stage aims to transform the requirements that have been collected into precise technical specifications. In this stage, the system architecture is planned, the user interface design is created, and the overall system design is organized. This process also uses BPMN and UML diagrams, including use case, activity, and class diagrams.
3. Implementation
   This stage involves translating the design into executable program code. The software development team will start writing and integrating code.
4. Testing
   Once the implementation is complete, the testing phase is carried out to ensure that the software functions correctly according to the specified requirements. Various types of testing, such as unit testing, integration testing, and system testing, are performed in this stage.
5. Maintenance
   Once the software is tested and declared ready, this stage involves installing the software into a production environment and preparing the system for use by end users.

RESULTS AND DISCUSSION

Identification of System Requirements

The results of the system requirements analysis from the interview process to develop a collaboration agreement monitoring system that is connected to Firebase and is website-based revealed that there are four entities or application users, namely administrators, partners, heads of offices, and visitors. System requirements include user data management, partner data management, collaboration data management, user activity tracking or user logs, collaboration reporting and monitoring, and notifications to notify users about collaboration updates. Figure 2 explains the system overview for the collaboration application process to collaboration validation, and finally, the end can see collaboration statistics. Figure 2 shows in detail the system developed using BPMN (Business Process Modeling Notation) to manage the collaboration application process up to the validation stage. The process begins with the user submitting a collaboration application by a partner, who then goes through a series of steps specified in BPMN notation, including data validation verification, and approval. After going through these stages, the collaboration will be validated and ratified so that it can proceed to the implementation stage. The system is also equipped with a collaboration statistics feature that allows users to track and analyze the collaboration data that occurs.

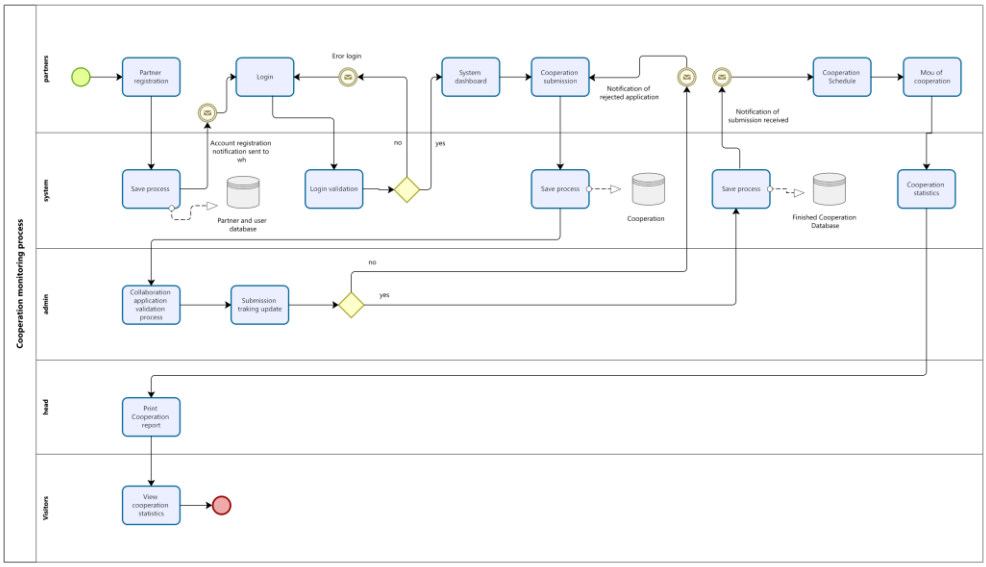

Figure 2: System BPMN

System Design

This system design uses the Firebase architecture, which utilizes various integrated services to create efficient and scalable applications. In this design, four main features of Firebase are used:

1. Firebase Authentication handles user login and registration securely without the need to manage an authentication server.
2. Firebase Realtime Database or Cloud Firestore functions to store and synchronize data in real time across users, ensuring the application provides a responsive and always up-to-date experience.
3. Firebase Storage provides a file storage solution that is well-integrated and easy to access from the application.
4. Firebase Hosting allows developers to host static websites and dynamic content quickly and securely.

Using this Firebase architecture allows developers to save time and resources, as opposed to traditional architectures that require managing physical or virtual infrastructure, including storage, databases, and application servers, which often require deep technical expertise and longer development time. Figure 3 explains the differences between the Firebase system architecture and traditional architecture.

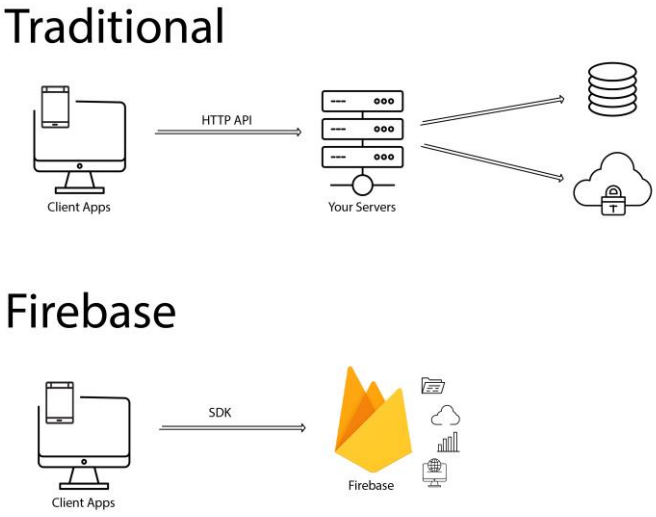

Figure 3: Systems Architecture

The system is structured using PHP and JavaScript as programming languages. System integration with Firebase goes through several stages. First, users create a new project in the Firebase Console and configure the Firebase SDK in their web app. This step includes downloading and adding the Firebase SDK JavaScript script to the web page, as well as initializing Firebase in the JavaScript code. Users also need to configure Firebase authentication, database, and storage via the Firebase Console. The second stage involves backend integration with Firebase using PHP. For this, developers use the Firebase Admin SDK for PHP. JavaScript is used to interact with Firebase services through the Firebase SDK, handling user authentication and other CRUD (Create, Read, Update, Delete) operations. This system was developed using UML (Unified Modeling Language) modeling, which involves the use of use case diagrams and class diagrams. UML is an object-oriented modeling method used to design and create software. UML includes various diagrams such as use case diagrams, activity diagrams, and class diagrams. The following is a more detailed explanation regarding the use of UML in the system being designed.

Use Case Diagram

The diagram below describes the activities carried out by the actors in the system being built. There are four main actors, namely Admin, Partner, Head of Office, and Visitors, who have their respective roles and responsibilities. Admin acts as the primary manager who is responsible for managing various kinds of data, including user, partner, and collaboration information. Apart from that, the Admin also monitors user activity, reports, monitors cooperation developments, and provides cooperation MOU templates. Meanwhile, Partners, as the second party, register, apply for collaboration, and track ongoing collaboration. Partners can also download agreed cooperation MOUs, as well as receive notifications via platforms such as WhatsApp and Gmail. The head of the office is responsible for providing cooperation status reports to related parties, arranging cooperation schedules, and also has the right to download cooperation MOUs. Meanwhile, visitors, even though they have limited access, can view collaboration reports in statistical form, which provides transparency and essential information to the public or parties who have an interest in the collaboration.

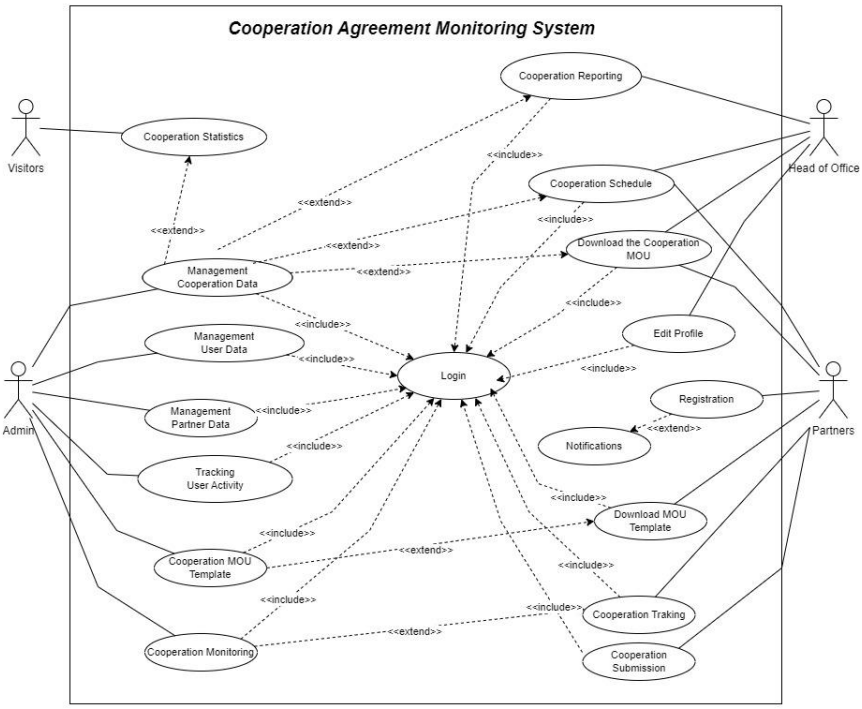

Figure 4: Use Case Diagram of System

Class Diagram

The Class Diagram illustration in Figure 5 has a vital role in facilitating the system modelling process. This Class Diagram clearly shows the structure and relationships between elements in the cooperation agreement monitoring information system. Information about class names, attributes, and operations related to the system's functions is presented in detail. As a handy tool, Class Diagrams help in adequately understanding the structure and logic of the information system, as well as facilitating the subsequent analysis and implementation process.

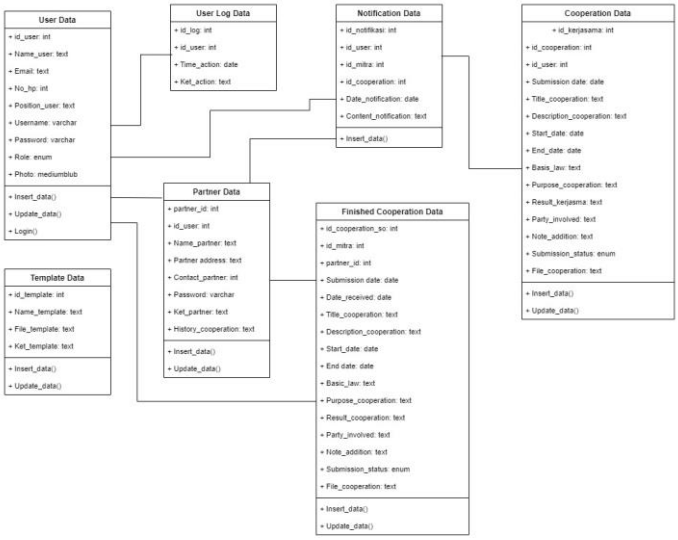

Figure 5: Class Diagram of System

Activity Diagrams

Activity diagrams are used to describe behaviour in business processes that are not tied to specific objects. This diagram models the process vertically and horizontally. The activity diagram below shows the role of actors in the information system for monitoring cooperation agreements. Figure 6 is an activity diagram for visitors, who can view system information such as collaboration statistics, partner registration, and the system homepage without needing to enter the system. Figure 7 depicts partner activities in the system, starting from partner registration to submitting collaboration and tracking collaboration. Figure 8 explains the activity diagram for the head of the office, who can view reports and schedules and download cooperation MOUs. Meanwhile, Figure 9 shows the activity diagram for admins, who can manage all available features.

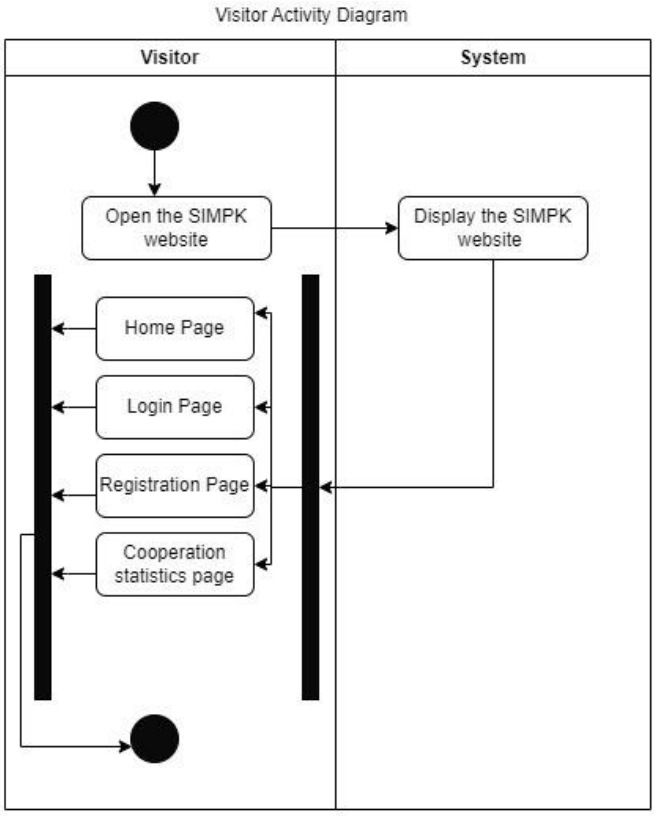

Figure 6. Activity Diagram of Visitor

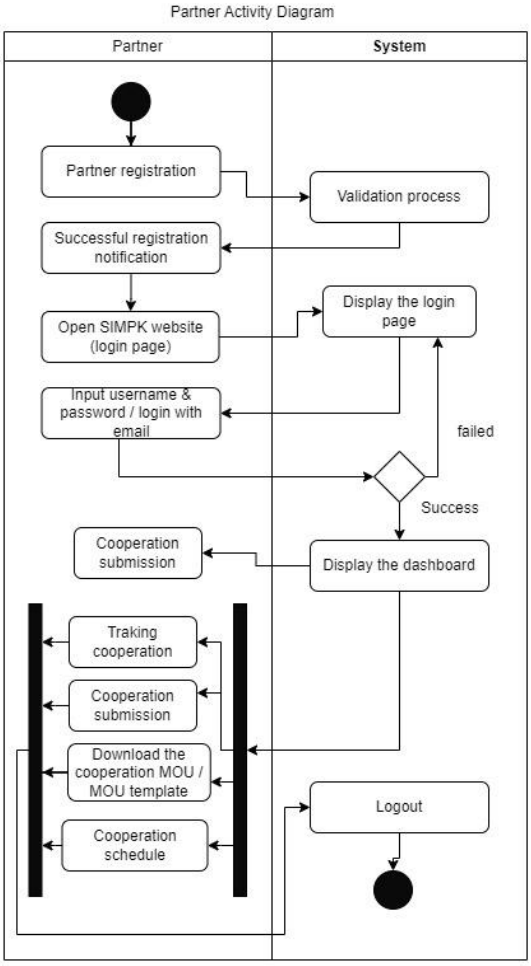

Figure 7: Partner Activity Diagram

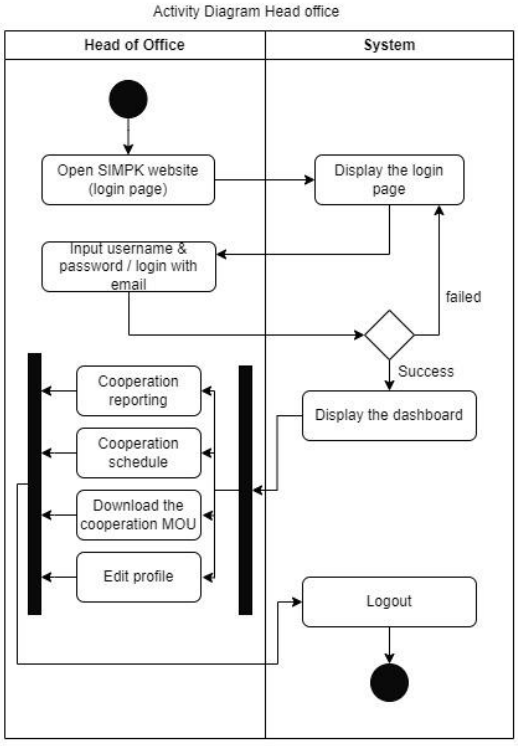

Figure 8: Activity Diagram Head of office

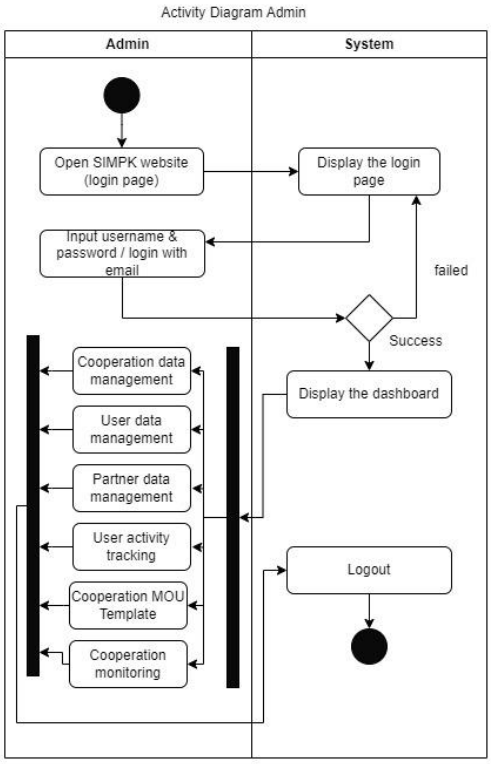

Figure 9: Activity Diagram Admin

System Implementation

1. Firebase configuration

   Configuring Firebase into a project using JavaScript: The first step is to create a Firebase project and register the system under development via the Firebase Console. Create a new project and add the required features to the system. Several Firebase services used in this research include Firebase Authentication, Firebase Realtime Database or Cloud Firestore, Firebase Storage, and Firebase Hosting. Next, add code into the PHP file to call Firebase by installing the Firebase Admin SDK. The Admin SDK is a set of server libraries that can interact with Firebase from a privileged environment to perform various actions. The final step is to initialize Firebase with JavaScript.

```
<script>
    // Konfigurasi Firebase aplikasi web Anda
    var firebaseConfig = {
        apiKey: "YOUR_API_KEY",
        authDomain: "YOUR_PROJECT_ID.firebaseapp.com",
        databaseURL: "https://YOUR_PROJECT_ID.firebaseio.com",
        projectId: "YOUR_PROJECT_ID",
        storageBucket: "YOUR_PROJECT_ID.appspot.com",
        messagingSenderId: "YOUR_MESSAGING_SENDER_ID",
        appId: "YOUR_APP_ID"
    };

    // Inisialisasi Firebase
    firebase.initializeApp(firebaseConfig);

    // Reference to the database
    var database = firebase.database();
</script>
```

Figure 10. Image of Firebase Configuration in JavaScript

2. System Views

   The system's design and design steps are implemented into program code using PHP and JavaScript languages and the JSON REST API method for connection to Firebase. Figure 11 shows the website login page interface, designed for access by partners, admins, and head offices. Visitors can view collaboration statistics on the web page without needing to log in.

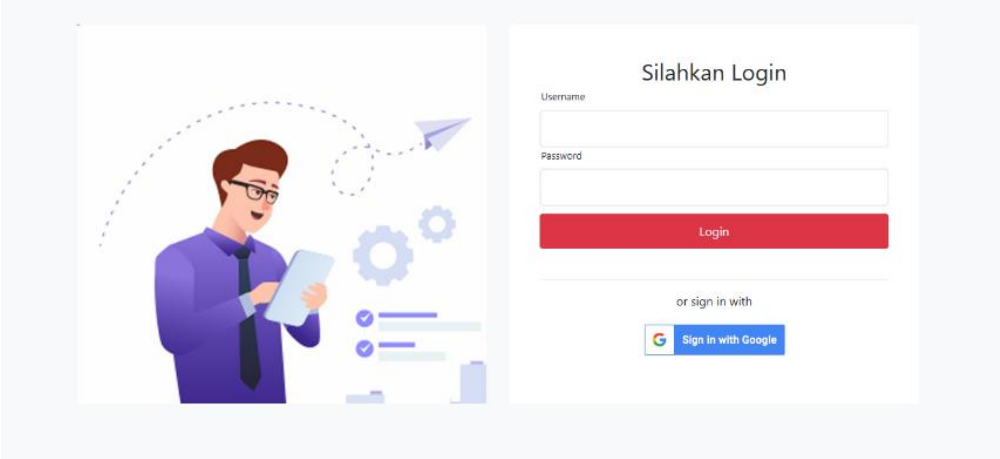

Figure 11. System Login Page Display

The user will be redirected to their dashboard if the login is validated successfully. The features available on the dashboard are adjusted to the user's needs in the system being built. Figure 12 provides an overview of the dashboard layout for administrators, while Figure 13 illustrates the features available to partners.

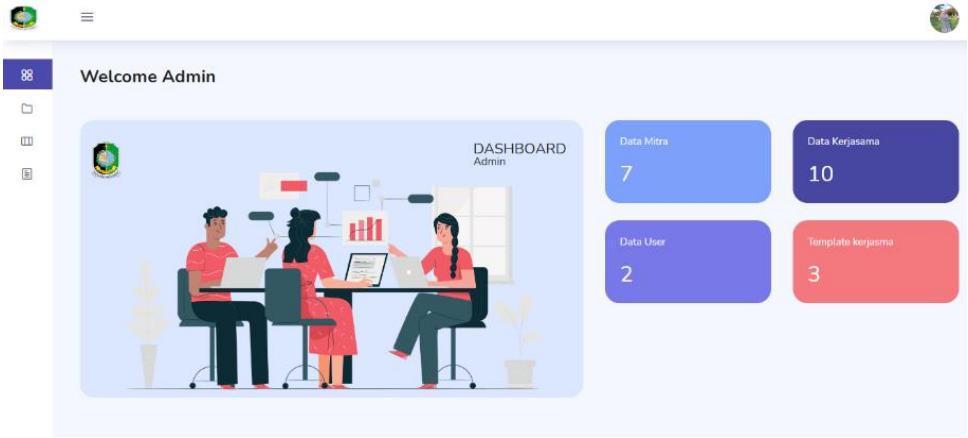

Figure 12. Admin Dashboard Display

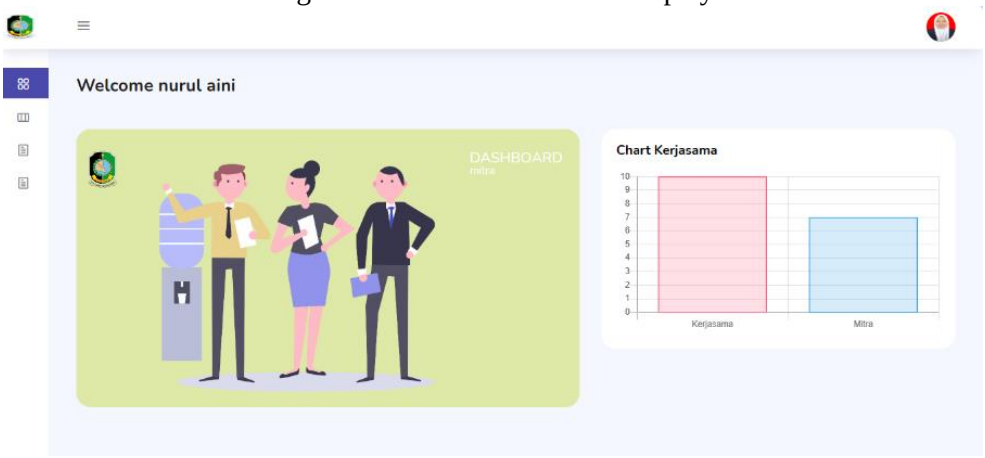

Figure 13. Partner Dashboard Display

CONCLUSION

Using a web-based Cooperation Agreement Monitoring Information System integrated with Firebase can facilitate the process of submitting, monitoring, and evaluating cooperation. This system ensures that data about cooperation and partners is stored safely and organized in the form of a database and can generate reports and statistics about the cooperation that has been carried out. By utilizing Firebase, developers can focus more on developing the user interface because the Backend is managed by Firebase, which uses the Backend as a Service (BaaS) concept. Firebase RealtimeRealtime Database enables live

data synchronization, so the system can still operate offline. Firebase Authentication simplifies user management, while applications can be hosted directly with Firebase Hosting and Storage. In addition, the system will be equipped with a notification feature via email and WhatsApp API to provide notifications about the application's status and monitor the agreement's progress.

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