

Development of User Management in Ihya Digital Ecosystem Using Iterative Incremental Method

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Abstract— Information systems have an essential role in the development of technology and information in Indonesia. Information systems are employed and utilized in many facets of society and organizations. Digitizing and utilizing this information system will often form an integrated relationship between several digital sectors into an ecosystem or what is commonly called a digital ecosystem. Digital ecosystem provides benefits for users by exchanging data between systems within it since only one user account could access several systems or services in the ecosystem. The development of user management in the digital ecosystem will serve as a solution to accommodate the increasing number of users of the digital ecosystem. Iterative incremental development methods are used in the development of user management in Ihya digital ecosystem. The system was also tested using scenario tests, user acceptance tests, and load tests. Based on the results of the tests, the Ihya digital ecosystem user management module has met user needs with a User Acceptance Test value of 82.5%. Further development can be done in this research, including using APIs in the data exchange process and adding a two-factor authentication feature to improve data security.

Keywords— user management, digital ecosystem, iterative incremental, scenario, user acceptance, load, test

I. INTRODUCTION

Information systems have an essential role in developing technology and information in Indonesia. Coincidentally, Covid-19 is also causing the technology development, which affects not only Indonesia but also the rest of the world. The digital economy in Indonesia recorded a value of IDR 632 trillion, or 4% of the total GDP. In addition, the government estimates that Indonesia's digital economy transactions can reach IDR 4,531 trillion by 2030 [1]. The internet penetration rate in Indonesia in 2021-2022 is 77.02%, with a total of 210,026,769 internet users, an increase of 3.32% from the previous year [2]. Based on this data, Indonesia has great potential to build a better digital ecosystem to meet the needs of its population. In addition, according to a survey to determine how much society needs a digital ecosystem, 55.3% of respondents stated that the community needs a digital ecosystem. In addition, based on a survey to the

community, the most needed services in a digital ecosystem are donations (59.6%) and investment services (42.6%). Another survey was also conducted to determine the need for user management as an account management module in the digital ecosystem. The results showed that 75% of respondents admitted that they did in fact require user management to manage their accounts.

Digital ecosystem is a combination of several independent services that form a larger service [3]. The digital ecosystem is formed due to business networks and information technology development. The purpose of the digital ecosystem is to increase the efficiency of communication between services to develop the existing business ecosystem. [4]. The digital ecosystem is an adaptation of a biological ecosystem that has a strong architecture and can adapt to changes quickly [5]. Therefore, the digital ecosystem has characteristics that can easily adapt to changes and the development of a wider system. Based on these explanations, a digital ecosystem can be developed to meet the service needs of survey respondents. Another reason for developing Ihya digital ecosystem is to serve as a one-stop service for users who want to invest in one integrated service and donate to charity. Users can donate to charities and invest by using their single account that had been previously registered in the Ihya digital ecosystem. Furthermore, users will be able to manage their activities and transactions that have been done across all services offered by the Ihya digital ecosystem. It occurred as a result of data exchange between services offered by the Ihya digital ecosystem.

Based on previous research that implemented user management in a laboratory with a Linux primary domain controller, the test results revealed that the administrator's assigned roles were 100% successful. Users did not lose any information because all data was stored on the server [6]. Meanwhile, in another study that implemented user management in smart homes, user management was used to manage users based on the access rights granted by the administrator. Furthermore, during testing, the system responded 93% successfully with a response time of 600 to

1789 milliseconds [7]. The development of user management could be a solution to accommodate the increasing number of users of the Ihya digital ecosystem.

The iterative incremental method is needed for development of the Ihya digital ecosystem development. Iterative incremental is a method that combines two methods, iterative and incremental, to overcome the weaknesses of the waterfall method. This method is carried out using an iterative cycle and developed in smaller portions at a time (incremental) [8]. The iterative incremental method is considered quite beneficial for limited resources when viewed from the simplicity and improvements made during the development process [9]. In order to assess system performance and ensure that user needs were met, testing was also done on the results of user management development in the Ihya digital ecosystem using scenario tests, user acceptance tests, and load tests.

II. LITERATURE REVIEW

A. User Acceptance Test

User Acceptance Test serves to ensure that the product or system developed will be able to handle real-life usage scenarios. This test can be done with a demo, but if the system being developed is complex, a more formal acceptance test is needed. [10]

B. Load Test

Load Testing is a type of non-functional testing to determine the system's response to the number of user clicks and check how well the application handles traffic.[11]

C. Scenario Test

Scenario testing is a method that gives the user several scenarios to run and is used for finding bugs in the system.[12]

D. Iterative Incremental

The iterative incremental method is done by developing features according to requirements and the product owner provides feedback. If there are no problems with the current feature, the development process can be continued on the next feature. These steps are repeated until the entire application is developed. This method supports a development process that is flexible to changes and additions to specifications.[13]

The comparison of schedule, cost, and technology factors between iterative incremental and other development methods is described in Table I.

TABLE I SDLC Development Method Comparison[14]

Factors	Water fall	V-Shaped	Evolutionary Prototyping	Spiral	Iterative Incremental
Short Time Schedule	Poor	Poor	Good	Poor	Excellent
Cost Limitation	Poor	Poor	Poor	Poor	Excellent
Unfamiliar Technology	Poor	Poor	Excellent	Excellent	Good

III. METHODOLOGY

The purpose of developing user management in the Ihya digital ecosystem is to provide features or facilities to manage their accounts so users do not need to perform repetitive

activities when managing accounts registered in the Ihya digital ecosystem.

Based on the comparison presented in table I, the iterative incremental method has many advantages in terms of short time schedules, cost limitations, and unfamiliar technology, which are essential aspects of the user management development process in the Ihya digital ecosystem.

A. Research Framework

The development process of user management in the Ihya digital ecosystem goes through iterative incremental, evaluation and deployment stages. These stages are described as follows.

1) Iterative Incremental Stage

Iterative incremental is a development method that will be used in the user management development process in the Ihya digital ecosystem. The iterative incremental method is divided into planning, design, development, and testing phases. The steps to be performed in the iterative incremental method are shown in the Fig.2 below.

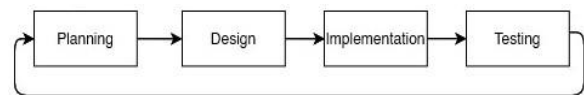


Fig. 1 Stages in iterative incremental

a) Planning

At this stage, the process of analyzing and gathering user requirements is done, which will be used as the basis for development.

b) Design

At this stage, a system design will be produced in the form of a UML diagram based on the data obtained at the planning stage and will be used as the basis for the implementation stage.

c) Implementation

At this stage, the planning and design stages that were previously completed are being implemented and put into code.

d) Testing

The testing stage is used to determine the functionality and reliability of user management. This stage also provides an opportunity for users to provide suggestions for further development.

2) Evaluation Stage

At this stage, an evaluation of application development is carried out with users who test the application. The evaluation stage will be used as the basis for improvement or further development.

3) Deployment Stage

At this stage, the coding results of the user management will now be uploaded to the server as storage media and used to run the application, allowing for public access.

IV. RESULTS AND DISCUSSION

A. GAP Analysis

GAP analysis is the stage to determine the existing condition of the current application or system with the system that will be developed. GAP analysis is obtained from observations of similar systems that already exist, Kitabisa

and iGrow platforms. Both platforms are independent and have not been incorporated into a digital ecosystem. These observations produce a GAP analysis table described in Table II. The notation given to the GAP analysis is explained as follows.

- N** = Conditions do not meet needs
- P** = Conditions partially meet needs
- F** = Conditions have met the needs

TABLE II GAP analysis

Needs	Existing Condition	Fulfillment			Solution
		N	P	F	
Users want to be able to invest and donate to charity using a single account	In the current condition, charity and investment services are still in separate systems or applications	V			Creating investment and charity services in one ecosystem that can be accessed with one account
Users want to manage accounts registered in the charity and investment features at the same time	In the current condition, charity and investment services still use different accounts to access their services	V			Create a user management module that allows users to manage accounts registered with other services in the ecosystem on one page
Administrators can manage accounts registered to two services in the ecosystem at the same time	Currently, account management is still separate between charity and investment services	V			Create a user management module that allows administrators to manage user data registered in the Ihya digital ecosystem.

B. Feature Needs Analysis

This step is to determine the features needed in the development of user management in the Ihya digital ecosystem based on the GAP analysis results. This analysis produces several key features needed in user management, namely:

1. User management allows administrators to do user management activities, including adding new user accounts, changing user data, deleting user accounts, verifying user identities, and viewing a summary of the activity and growth of active users in the Ihya digital ecosystem.
2. Users can access other services in the Ihya digital ecosystem using an already registered account. In addition, users can also see a summary of activities carried out within the Ihya digital ecosystem.
3. Users can manage personal data required for activities on other services and apply for identity verification in order to conduct transactions on other services provided by the Ihya digital ecosystem.

C. Use Case Diagram

Fig.3 shows the use case diagram of user management in the Ihya digital ecosystem. A use case diagram is a diagram that describes the relationship between users and the system. The use case diagram depicts all activities that can be

performed when using the system. Based on the use case diagram in Fig.3 there are several types of users who can access and perform activities with user management in the Ihya digital ecosystem according to their access rights.

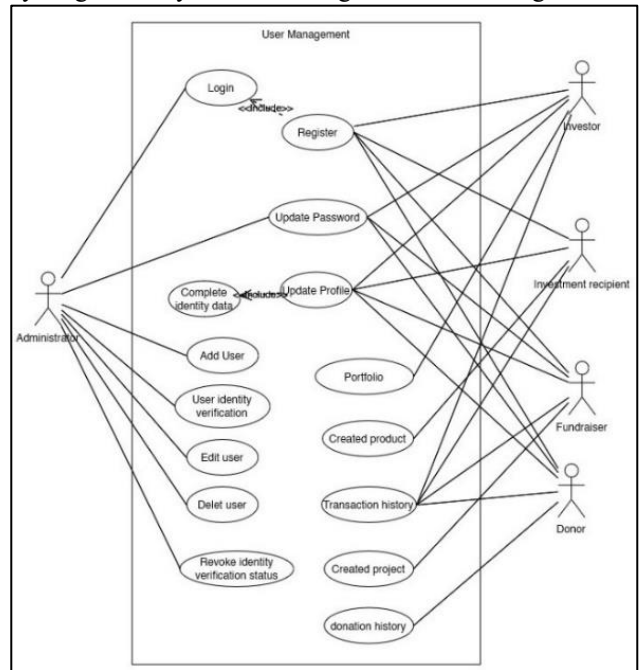


Fig. 2 Use case diagram

D. Entity Relationship Diagram

An entity relationship diagram is a diagram that describes the structure of the data contained in the system and the relationships between the system's entities. The ERD in Fig. 4 describes the data relationships used in the user management of the Ihya digital ecosystem. All of this data is needed and used to run a user management system in the Ihya digital ecosystem.

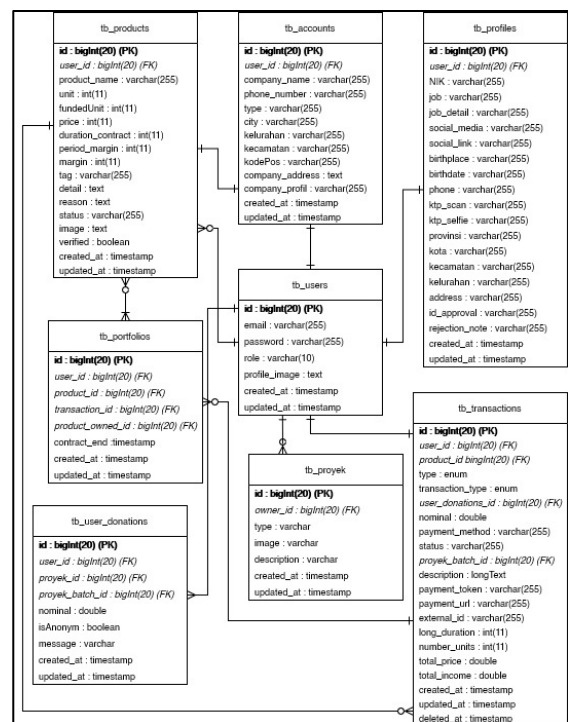


Fig. 3 Entity relationship diagram

E. First Iterative Incremental Phase

1) Planning

At this stage, the user management features for the Ihya digital ecosystem are being planned. Depending on the role or access rights that the user has, there are various different features.

2) Design

The design stage, also known as the system design step, will serve as the foundation for the development of user management.

3) Implementation

During the implementation stage, the plans and designs created in the earlier stages are translated into code. The implementation stage will produce the web described in Fig. 5 to Fig. 7

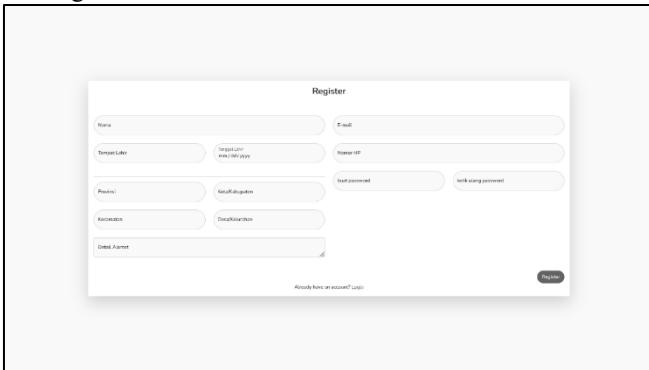


Fig. 4 Registration page

on the registration page, the user can register himself to be able to use the Ihya digital ecosystem (Fig.5).

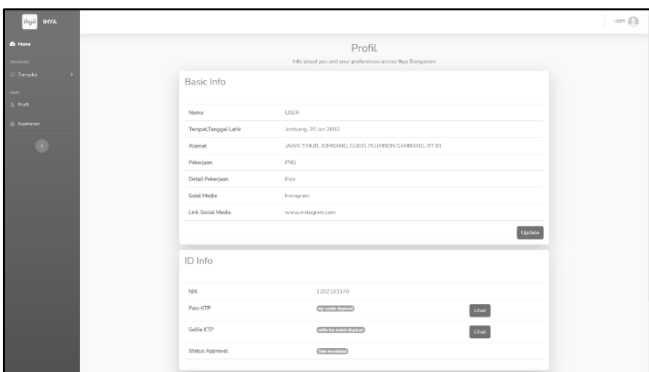


Fig. 5 User profile page

On the user profile page shown in Fig.6, users can manage their data and verify their identity to use Ihya digital ecosystem services fully.

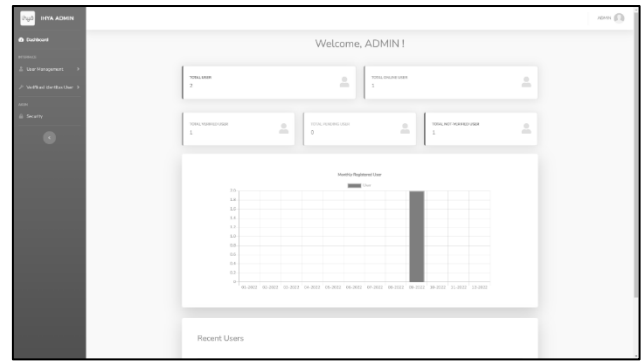


Fig. 6 Administrator dashboard

This page allows administrators to see a summary of user management activities in the Ihya digital ecosystem, as shown in Fig. 7.

4) Testing

The testing stage is the stage to ensure that the user management that has been developed has met the user's needs and can be appropriately used without any problems. The testing method carried out at this stage is scenario test by providing 7 scenarios that will be run by the user, and the result is that the user can run all scenarios.

5) Evaluation

At this stage, user input is obtained for the evaluation, which tested the user management of the Ihya digital ecosystem. Some suggestions given by users are:

1. Reduce data that needs to be filled in during the registration process and replace it with notifications for when users need to finish entering personal information after successfully registering an account and logging into user management websites.
2. Add more data that the administrator can manage on the dashboard page.

F. Second Iterative Incremental Phase

1) Planning

The second iterative incremental phase focuses on adding features and improving or optimizing features created in the first iterative incremental phase based on user input during the first phase of testing.

2) Design

The design phase in the second iterative incremental phase did not change from the first phase. The design stage is done by designing use case diagrams, activity diagrams, class diagrams, and entity relationship diagrams (ERD).

3) Implementation

The implementation stage involves making or implementing the previous planning and design stages into code. The results of the implementation stage in the second phase iteration are described in Fig.8 and Fig.9 below.

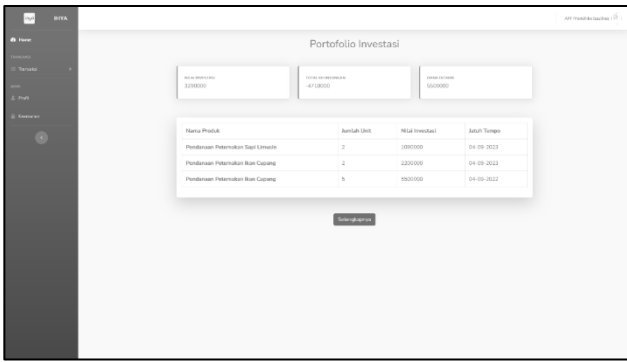


Fig. 7 User portfolio page

The portfolio page shown in Fig. 8 is for users to see a summary of investments made in investment services in the Ihya digital ecosystem.

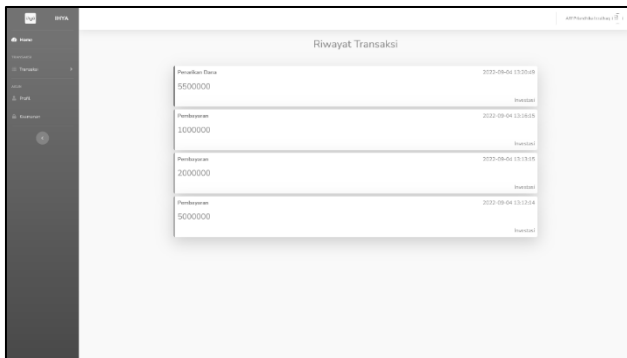


Fig. 8 Transactions history page

On the transaction history page shown in Fig. 9, users can see the history of transactions created by other services in the Ihya digital ecosystem.

4) Testing

Testing stage in the second phase only focuses on the features created in the second iterative incremental phase. This stage implements the scenario test, user acceptance test, and load test method.

a) Scenario Test Result

Based on the test, the user successfully executed 100% of the scenarios. This test is done by providing the user in user management with a scenario to complete.

b) Load Test Result

Load testing is done to determine the performance of user management in the Ihya digital ecosystem in response to user requests. As a result, user management in the digital ecosystem can handle a total of 1482 with a response time of 6620 ms, which are shown in Fig. 10 below.

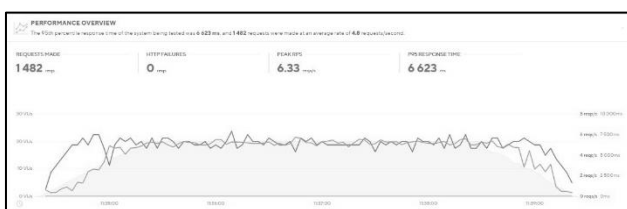


Fig. 9 Load test result

c) User Acceptance Test Result

The user acceptance test was conducted based on a survey with six respondents, who are potential users of the Ihya digital ecosystem and range in age from 18 to 30. Respondents are asked 19 questions regarding user management web functionality. They will give a value in the range of 1 to 4. A value of 1 for poor web functionality and 4 for excellent web functionality. Based on the test, user management in the Ihya digital ecosystem scored 381 out of 480, or 82.5%.

5) Evaluation

At this stage, the user does not give input for improving the features developed in the second phase, hence it can be concluded that the feature has met the user's needs and is ready to be implemented and used by the user.

6) Deployment

The deployment stage is completed after all stages in the first and second iterative incremental phases are completed. The deployment stage of the digital ecosystem user management is done by uploading code on the domain and server using CPanel as a control panel in the deployment process on the server.

V. CONCLUSION

Based on the results of user management development, it can be concluded that this research has succeeded in developing features needed by users to manage accounts used in the Ihya digital ecosystem. This study also implemented the iterative incremental development method, which was divided into two iterations. It was successfully tested, received an 82.5% in the user acceptance test, and is now ready for implementation.

Suggestions for further research on the development of user management in the Ihya digital ecosystem are to create a two-factor authentication feature and use an API as a data exchange interface. These steps would increase data security and boost the effectiveness of algorithms to improve application performance.

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