RESEARCH ARTICLE

JENER Journal of Empirical and Non-Empirical Research
Volume 2, Issue 3, Page 528-540 | Article No. 74
DOI: 10.4898/jener.v2i3.a74
ISSN: 7895-9216
Journal homepage: https://jenerjournal.com
Journal email: editor@jenerjournal.com

JENER Journal
JENER Journal of Empirical and Non-Empirical Research

Bali Investment Club Investor Portal Information System Utilizing OpenAI Artificial Intelligence (Web-Based)

Michael William Pratama Wenas[1]

[1]Department of Information Engineering, Institut Teknologi dan Bisnis STIKOM Bali

ARTICLE INFORMATION

Article history:
Published: March 2026

Keywords:
Bali Investment Club
New Paradigm
ReactJS
Express
Artificial Intelligence

ABSTRACT

In the digital era, business and investment have experienced significant changes. Bali Investment Club is taking a step forward in using artificial intelligence technology in their investment business. Bali Investment Club is focused on getting the best results for its members as they support the New Paradigm initiative. The business entity decided to develop an investor portal operating system that uses artificial intelligence and a framework that reflects their place of business. The ReactJS framework is used for a responsive and interactive user interface on the client side, while the NodeJS framework functions as a web server that responds to API requests from Express. This information systemuses MongoDB as a database. The connection between the NodeJS web server and the MongoDB database is managed using the Express framework backend. Artificial intelligence uses Codex and GPT-3 smart agents. The project was developed using the waterfall method. In creating this system, the planning and design concept goes through the data collection stages in the form of interviews, Data Flow Diagrams (DFD), Entity Relationship Diagrams (DFD) and implementation. Usability testing was carried out on the interface and user experience, gray-box testing on the system, and user acceptance testing by the company. The results of research and development prove that an investor portal information system has been developed and tested that works optimally, and with artificial intelligence and a framework that reflects the Bali Investment Club.

1. Introduction

In today's digital era, business and investment sectors have undergone significant transformations. Many companies are seeking novel ways to manage their investments with greater effectiveness and efficiency. Concurrently with the advancement of information technology, numerous firms are striving to leverage artificial intelligence to enhance their investment performance. However, substantial challenges remain to be addressed regarding the implementation of artificial intelligence technologies within the investment business landscape. The Bali Investment Club stands as one such entity taking proactive steps to integrate artificial intelligence technology into its investment operations.

The Bali Investment Club is a registered business entity managed by a team comprising individuals who hold international MBA degrees and possess extensive experience in establishing and scaling their own enterprises. Their committee also includes senior financial managers and trust fund managers. The Bali Investment Club is dedicated to securing optimal returns for its members, as it champions the "New Paradigm" initiative.

In the context of investing, a "New Paradigm" constitutes a revolutionary concept—a novel approach to conducting business that supersedes established beliefs and traditional methodologies [1]. Through interviews conducted by the researcher with representatives of the business entity, a strategic decision was reached to develop an investor portal operating system. This system is designed to leverage OpenAI's artificial intelligence capabilities and utilizes a technical framework—specifically the MERN stack—that aligns with the entity's operational environment. The integration of finance and artificial intelligence can effectively mitigate potential risks; furthermore, the inherent advantages of AI can be harnessed to vigorously develop and promote intelligent financial models. Such information system technologies remain a rarity within Indonesia's digital business landscape [2–3].

A system is a collection of interconnected elements that collaborate in a coordinated manner to achieve specific goals or objectives. Information refers to data that has undergone processing to endow it with meaning and utility within a specific context [4]. An Information System (IS) is a structured and integrated framework that combines social, technical, and organizational components with the aim of effectively collecting, analyzing, storing, and disseminating information. It is designed to facilitate the efficient flow of data and information throughout an organization, thereby supporting its operations, decision-making processes, and overall performance [5]. From a sociotechnical perspective, an information system consists of four essential components: tasks, people, structure (or roles), and technology. These components work together in an integrated manner to achieve the objectives of an information system [6].

This research is expected to contribute to the development of information technology within the business sector in Indonesia. By assisting companies—such as the Bali Investment Club—in developing and implementing artificial intelligence technologies

within their investment operations, we can help enhance their investment performance and deliver greater benefits to their members. Furthermore, this study is also expected to contribute to the development of a "New Paradigm" concept for the investment business in Indonesia, paving the way for a more innovative and effective transformation of the investment sector in the future.

2. Literature Review

In developing an investor portal information system—one that utilizes artificial intelligence and a framework reflecting their business environment—this company faced numerous challenges and obstacles. One of the most significant challenges was the relative lack of information technology development within the business sector in Indonesia. Information system technologies, such as those employed by the Bali Investment Club, remain scarce and have not yet been widely implemented within Indonesia's digital business landscape. A well-designed and efficient investor portal holds the potential to contribute positively to socio-economic outcomes by enabling investors to make informed decisions, manage risk, and optimize returns [7].

In the development of this information system, JavaScript emerged as the dominant programming language, utilized primarily through the open-source ReactJS framework for the frontend [8] and the efficient NodeJS framework for the backend [9]. The ReactJS framework was employed to develop a responsive and interactive user interface on the client side, while the NodeJS framework served as the web server, handling API requests routed through Express. This information system utilizes MongoDB as its database server—a NoSQL database that stores data in a document-based format [10]. The connection between the NodeJS web server and the MongoDB database is managed via the Express backend framework, which supports middleware functionality [11]. To ensure security and user authorization, JSON Web Tokens (JWT) were implemented, thereby enabling authenticated users to gain appropriate access to the various features within the investor portal.

The investor portal also facilitates the creation of distinct user roles—such as standard users and administrators—each endowed with corresponding access privileges and features. By integrating these various technologies, the Bali Investment Club has successfully developed a sophisticated, efficient, and secure investor portal system, further enhanced by the potential for artificial intelligence integration—specifically through Codex and GPT-3 smart agents—to facilitate investment analysis, portfolio recommendations, and more intelligent decision-making.

The research is centered at the offices of PT [PMA] Bali Investment BIC, located at Jalan Raya Sanggingan No. 36, Gianyar Regency, Bali; however, the information system development itself is conducted remotely. The software utilized includes the Codex intelligent agent and GPT-3, accessed via the OpenAI API—a process preceded by preliminary testing within the OpenAI Playground environment. The programming languages employed consist primarily of JavaScript, specifically utilizing the ReactJS framework for the frontend and NodeJS. The NodeJS web server handles API requests via Express, while the database server runs on MongoDB. The NodeJS web server connects to the ReactJS frontend and the MongoDB database through the Express backend framework. Within the investor portal, user authentication and authorization are implemented using JSON Web Tokens (JWT). In addition to implementing user authentication and authorization via JWT, the investor portal also supports the creation of distinct user roles to differentiate between standard users and administrators. The system facilitates the establishment of various user roles—such as standard users (USER) and administrators (ADMIN)—thereby distinguishing the access rights and available functionalities accorded to each user type. Users (USER) are granted access to the Bali Investment Club MERN Investor Portal dashboard, whereas administrators (ADMIN) have access to the Mongo Atlas database management dashboard, as well as the Dialogflow console dashboard, where conversation logs between users and the artificial intelligence agent can be reviewed.

3. Methodology

This Final Project proposal outlines a qualitative research approach based on the "Research and Development" (R&D) methodology. The "Research" component consists of interviews with corporate executives and usability testing—conducted by a focus group—regarding the information system's interface. The "Development" component—specifically the development of the information system—comprises the design, prototyping, and launch phases. In terms of the software development lifecycle, the Waterfall model is employed, consisting of analysis, design, development, and testing. Software verification is performed using gray-box testing.

Within the context of the Waterfall model applied to the development of this investor portal information system, the process consists of four distinct phases: analysis, design, development, and testing. The analysis phase involves conducting interviews with stakeholder representatives from the Bali Investment Club. The design phase focuses on the conceptualization of the UI/UX and AI features. The development phase encompasses the creation of the backend, frontend, and AI functionalities. Finally, the testing phase comprises gray-box testing, usability testing, and user acceptance testing. The Waterfall model is visually illustrated in Figure 1.

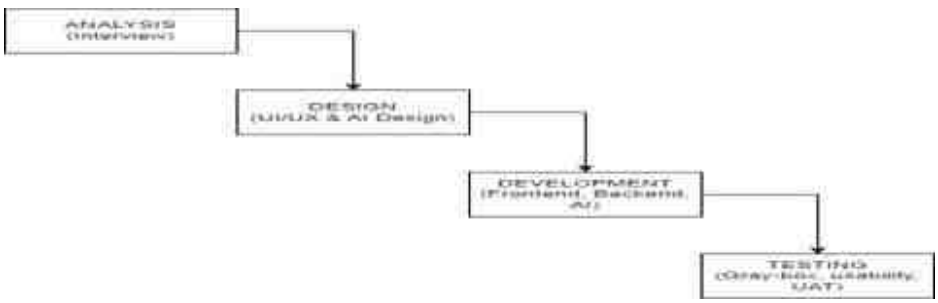

Figure 1: The Waterfall method used in development. Source: Research Data, 2023

The design phase of this research consists of:
UX/UI Design: Discussing the importance of User Experience (UX) and User Interface (UI) design in creating a dashboard that is intuitive and visually appealing. Explain the tools and technologies that will be utilized to design the dashboard, such as Figma, Sketch, or Adobe XD.
AI Feature Design: Detailing the design considerations for incorporating AI features into the dashboard. Discuss the specific AI technologies to be employed—such as machine learning algorithms or natural language processing—and their potential applications within the dashboard.
The development phase of this research consists of:
1. Front-end Development: Implementing the UI design using React, a popular JavaScript library for building user interfaces. Outline the components, state management, and routing that will be implemented during the front-end development of the MERN dashboard.
2. Back-end Development: Implementing server-side logic using Node.js and Express, including the development of REST APIs for data retrieval and manipulation. Explain the integration of MongoDB as the database for storing and managing data within the dashboard.
3. AI Feature Development: Developing the AI features and integrating these AI capabilities into the dashboard.
The experimental or testing procedures consist of:
1. Conducting Gray-box Testing: Performing tests on the source code of the Bali Investment Club Investor Portal Information System, covering both the front-end and back-end components.
2. Identifying Research Objectives and Target Users: Defining the research objectives for the usability testing to be conducted. Developing profiles for the target users who will participate in the usability testing process.
3. Preparing Scenarios, Tasks, Tools, and Materials: Formulating the testing scenarios and tasks that will be assigned to the target users. Providing the necessary tools and materials to execute the usability testing process—for instance, computers, software, or the specific interface under examination.
4. Recruitment and Selection of Target Users: Conducting the recruitment and selection of target users in accordance with the previously established profiles.
5. Execution of Usability Testing: Inviting target users to participate in the usability testing process.
6. Data Analysis: Analyzing the data collected from both the usability testing and gray-box testing processes.
7. Interpretation of Results and Preparation for UAT: Interpreting the data analysis results to draw conclusions regarding the functionality, efficiency, and user satisfaction concerning the product or interface under test. These conclusions must be supported by valid and objective data. Once a conclusion is reached, the information system is handed over to the stakeholders to facilitate the User Acceptance Test.
8. Report Generation: Compiling a report detailing the results of the usability testing, gray-box testing, and user acceptance testing.
9. Product Revision: Utilizing the results of the gray-box testing, usability testing, and user acceptance testing as input to implement improvements or revisions to the product or interface.
The academic project titled "Bali Investment Club Investor Portal Information System Utilizing OpenAI Artificial Intelligence (Web-Based)" employs a gray-box testing methodology, specifically utilizing regression testing techniques applied to both the user interface and the source code. This testing focuses primarily on environment integration, Luwak integration, data validation, user authentication, client-server connectivity, the user interface, and the intelligent chat system. Regression testing is centered on error scenarios, involving the execution of both positive and negative tests against the system's processes.
Usability testing for this project utilizes a formative research design. The technique employed is the "think-aloud protocol," wherein participants are asked to verbalize their thoughts regarding the user interface and user experience. The task scenarios consist of tests covering several specific pages: the Registration Page, Login Page, Home Page, Profile Page, Forms Page, and Statistics Page. Usability testing was conducted at a homestay named YU|PO – Homestay, where desktop computers equipped with internet access, monitors, keyboards, and mice were provided. The software used to execute the program was Microsoft Visual Studio Code, supported by the Java Runtime Environment, Java Development Kit, and NodeJS. Data collection was facilitated using Google Docs Speech-to-Text, which transcribed spoken conversations directly into a text format. This text was subsequently edited to be included as an appendix in the academic paper.
The latest phase of User Acceptance Testing (UAT) for the Bali Investment Club Social Investor Portal was conducted from November 13, 2023, to November 16, 2023. The primary objective was to ensure that the software met the specified requirements and was ready for production release. The testing environment utilized the Windows 10 operating system, Google Chrome and Safari web browsers, and a combination of desktop and laptop computers. The UAT focused on the following key areas:

- User Interface: Ensuring that the new UI design is intuitive and user-friendly.
- Functionality: Validating the core functions of the social investor portal.
- Compatibility: Confirm compatibility with major browsers.
- Security: Verify user authentication and data encryption.

4. Findings

4.1 Level 0 and 1 DFD

The provided information outlines the structure and interactions of the Bali Investment Club Investor Portal Information System. This system serves to facilitate communication and data exchange among administrators, users, and various modules—such as

login, profiles, forms, and statistics. The system is organized hierarchically, with varying levels of detail represented by Level 0 and Level 1 Data Flow Diagrams (DFDs), as well as an Entity-Relationship Diagram (ERD) for the database.

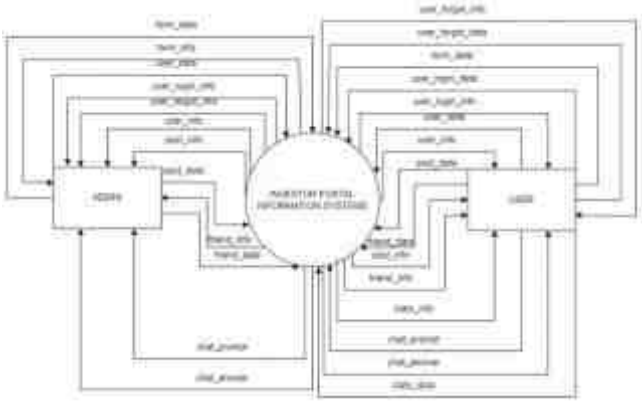

Figure 2: Level 0 DFD (Context Diagram). Source: Research Data, 2023

As illustrated in Figure 2, the highest level (Level 0) of the Bali Investment Club Investor Portal Information System is depicted as a circle. The system interacts with two primary entities: "ADMIN" and "USER." Administrators can provide and receive information via the Mongo Atlas dashboard, Novoform Spreadsheets, and the Dialogflow Console. Administrators supply form data, user data, post data, and connection data. Information for Administrators is provided in the form of form details, user login details, password recovery details, post details, connection details, user commands directed to the artificial intelligence, and the artificial intelligence's responses to those user commands. Users interact with the system by submitting data and obtaining information directly through the Bali Investment Club Investor Portal's MERN dashboard. The data provided by users consists of form data, user login data, password recovery data, user data, post data, connection data, and user commands directed to the artificial intelligence. The information obtained by users consists of user login details, password recovery details, user details, post details, connection details, statistical data, and the artificial intelligence's responses to user commands.

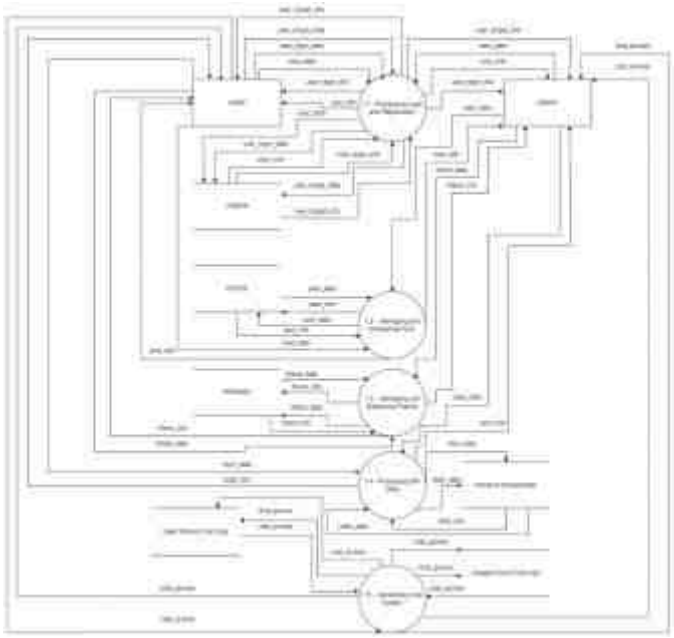

Figure 3: Level 1 DFD. Source: Research Data, 2023

As shown in Figure 3, at Level 1, the system's functionality is decomposed into several modules represented by circles, external entities represented by rectangles, and data stores represented by hollowed rectangles. "1.1 – Processing Login and Registration," "1.2 – Managing and Displaying Posts," "1.3 – Managing and Displaying Friends," "1.4 – Processing KPI Data," and "1.5 – Monitoring Intelligent Chat System" constitute the modules within the system, while "ADMIN" and "USER" once again represent the primary entities interacting with these modules. The data storage components consist of "USERS," "POSTS," "FRIENDS," "Novoform Spreadsheet," "Dead Simple Chat Logs," and "Google Cloud Chat Logs." Arrows within the diagram represent the flow of information between modules, entities, and data stores.

a. "Processing Login and Registration" handles data and information related to user login, password recovery, and registration.
b. "Managing and Displaying Posts" deals with user data and user post data, as well as related information.
c. "Managing and Displaying Friends" deals with user data and user friendship data, as well as related information.
d. "KPI Data Source" manages data from Google Forms and Google Sheets spreadsheets related to KPIs.

e. "Intelligent Chat System" encompasses the data and information involved in the GPT-3-Powered Novobot and the Live Chat feature on the Chat Page.

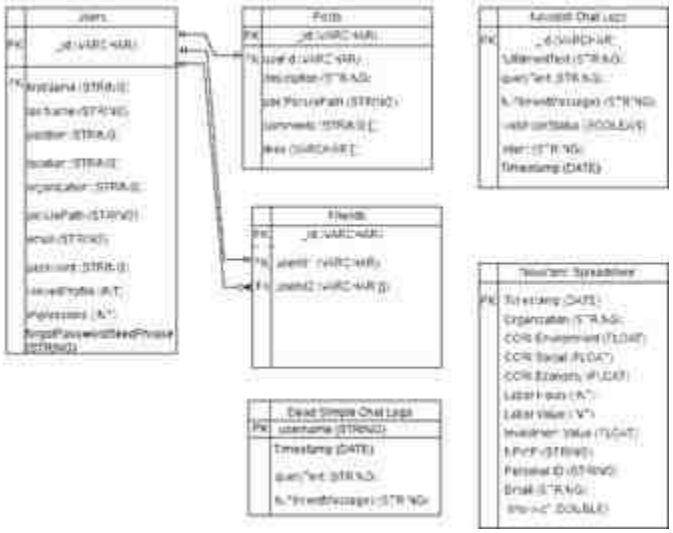

Figure 3: Database Entity-Relationship Diagram (ERD). Source: Research Data, 2023

As shown in Figure 4, the Entity-Relationship Diagram (ERD) within this project illustrates the underlying database schema structure for the Investor Portal. It consists of three main tables: "Users," "Posts," and "Friends" (the latter of which functions as a sub-document within another table). Each table possesses specific attributes:

1. Users Table: Contains user-related information, including the primary key "user_id," personal details such as first and last names, professional information (e.g., position and organization), contact details, login credentials, viewing activity, and impressions. In the Data Flow Diagram, this table corresponds to the "USERS" data store, where "user_data" and "user_info" are stored. "user_data" represents input data, while "user_info" represents output data.
2. Posts Table: Stores data related to posts, including the primary key "post_id," author details, post content, associated images, comments, and likes. In the Data Flow Diagram, this table corresponds to the "POSTS" data store, where "post_data" and "post_info" are stored. "post_data" represents input data, while "post_info" represents output data.
3. Friends Table: The data model for this table suggests that each record within the "Friends" table links a user (represented by "_id") to one of their friends (stored in "userId1") and potentially to multiple friends (stored in the "userId2" array). This design effectively models a one-to-many relationship between a user and their friends, wherein a user has one primary friend ("userId1") and several additional friends ("userId2").
4. Novoform Spreadsheet Table: This table stores data from a Google Sheets spreadsheet pertaining to KPIs that have been submitted via Google Forms. In the Data Flow Diagram, this data store is also designated as "Novoform Spreadsheet," where "form_data," "form_info," "stats_data," and "stats_info" are stored. “form_data” represents the input form data; “form_info” represents the output form data; “stats_data” represents the input statistical data (provided only by administrators); and “stats_info” represents the output statistical data.
5. Google Cloud Chat Logs Table: This table stores the conversation history between users and the artificial intelligence system via the Dialogflow console. In the Data Flow Diagram (DFD), this data storage is also referred to as “Google Cloud Chat Logs,” where “chat_prompt” and “chat_answer” are stored. “chat_prompt” represents the conversational data input by the user, while “chat_answer” represents the conversational data output by the artificial intelligence system.
6. Dead Simple Chat Logs Table: This table stores the conversation history between regular users and moderator users (live experts). In the DFD, this data storage is also referred to as “Dead Simple Chat Logs.” This table stores “chat_prompt” and “chat_answer.” “chat_prompt” represents the conversational data input by both types of users, while “chat_output” represents the conversational data output to both types of users via the Dead Simple Chat API.

The provided diagrams and descriptions illustrate how information flows through the Bali Investment Club Investor Portal Information System—ranging from user interactions to data storage within the database. The system design enables administrators and users to manage profiles, posts, KPIs, and connections within the platform.

4.2 Investor Portal Key Performance Indicators

The Labor-Value Ratio (LVR)—or Ratio of Labor Value—is a metric for Socially Beneficial Worker-Investor Economies. The LVR is calculated by dividing the total value generated by labor and worker-investor investments by the total labor hours expended.

LVR = (Total Labor Value + Total Investment Value) / Total Labor Hours

The LVR accounts for both the labor input and the investments made by workers to determine the value generated by their collective efforts. By utilizing this metric, societies can evaluate and optimize their economic systems to promote equitable outcomes for all participants.

The Cooperative Climate Resilience Index (CCRI) is a metric designed to evaluate Climate Awareness within Investment Cooperatives. The CCRI is derived from a weighted aggregation of indicators spanning environmental, social, and economic

dimensions specific to investment cooperatives. Each indicator is assigned a weight based on its significance and relevance to cooperative climate awareness.

CCRI = [∑(Indicator Value x Indicator Weight)] / Total Weight

The Cooperative Climate Resilience Index is a metric designed to assess the climate awareness of investment cooperatives. Recognizing the unique characteristics of cooperative structures, the CCRI considers environmental, social, and economic factors to evaluate a cooperative's commitment to addressing climate change.

The Integrated Metric for Sustainable Worker-Investor Cooperatives (IMS-WIC) is calculated by combining the scores from the LVR and CCRI, assigning appropriate weights to each metric to reflect their relative importance.

IMS-WIC = (LVR Score x LVR Weight) + (CCRI Score x CCRI Weight)

This integrated metric aims to provide a comprehensive evaluation framework for worker-investor cooperatives, taking into account both their economic performance and their commitment to climate awareness. By integrating LVR and CCRI, IMS-WIC promotes a balanced and sustainable approach to cooperative development, ensuring equitable outcomes for workers and a positive impact on the environment.

4.3 Investor Portal Interface

On the login and registration pages, the color scheme employs distinct shades for background and foreground elements, leveraging the `palette.theme` from Material-UI. Material-UI was chosen as it is a popular choice for building web interfaces within React applications. It adheres to the Material Design guidelines established by Google, ensuring a consistent and user-friendly design language. The use of `color="primary"` and `backgroundColor={theme.palette.background.alt}` is intended to demonstrate a consistent and thoughtful approach to styling. The login page also effectively utilizes varying font weights and sizes to establish a visual hierarchy, while the use of the `Box` component helps organize the different sections.

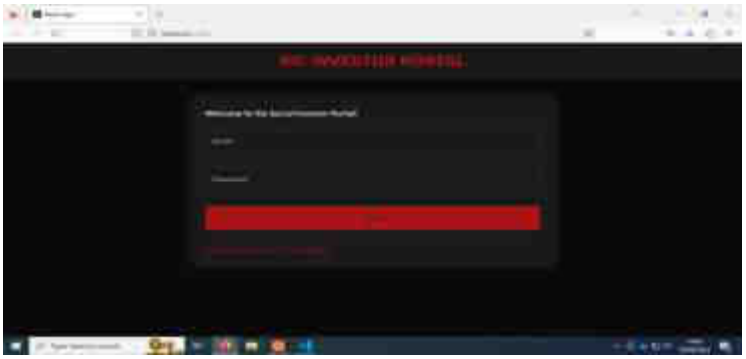

Figure 5: Login Page. Source: Research Data, 2023

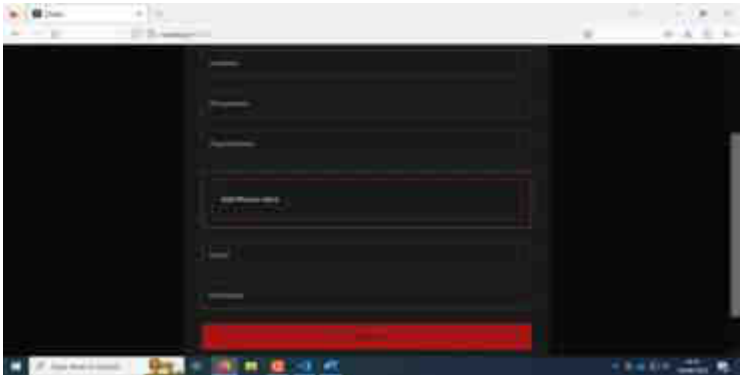

Figure 6: Registration Page. Source: Research Data, 2023

Figure 7: Forgot Password Page. Source: Research Data, 2023

The consistent application of padding and margin values is intended to maintain a balanced and organized layout. UI elements within the Form component are also ensured to be accessible, featuring appropriate labels, error messages, and keyboard navigation support. Accessibility considerations are paramount to a positive user experience.

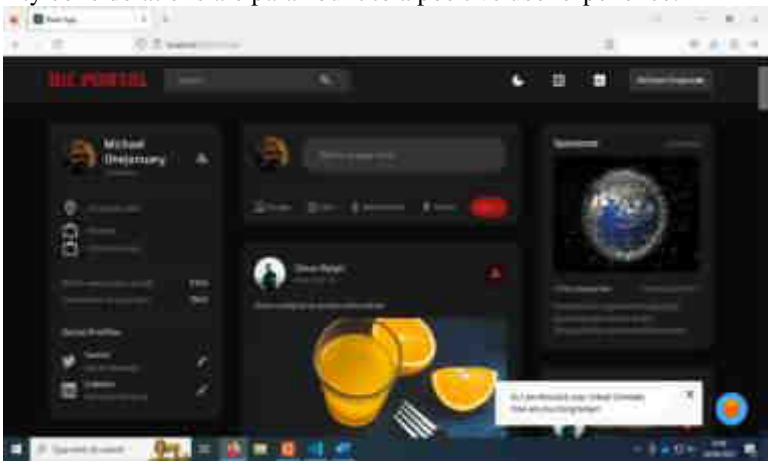

Figure 8: Homepage (Dark Mode). Source: Research Data, 2023

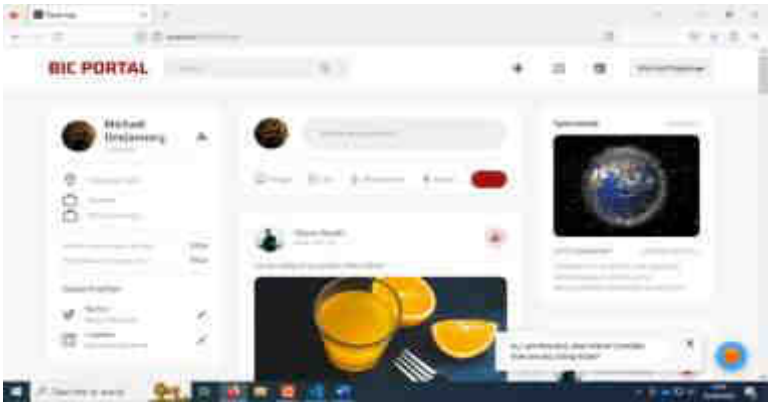

Figure 9: Homepage (Light Mode). Source: Research Data, 2023

The page incorporates a Navbar component, which is essential for user navigation and orientation. Proper navigation enhances the overall user experience. Its layout is designed to be responsive; it adapts to non-mobile screens by displaying content side-by-side, thereby utilizing screen real estate efficiently. For smaller screens, the page stacks content vertically to ensure optimal mobile usability. This page features various widgets, such as the UserWidget, MyPostWidget, PostsWidget, AdvertWidget, and FriendListWidget. These widgets provide users with quick access to relevant content and actions, thereby enriching the overall user experience.

The inclusion of the `df-messenger` component—which connects to Novobot, a GPT-3-powered assistant—offers users interactive and practical features, thereby boosting user engagement and support. Rather than occupying the entire page, it functions as a user assistant within a chat interface.

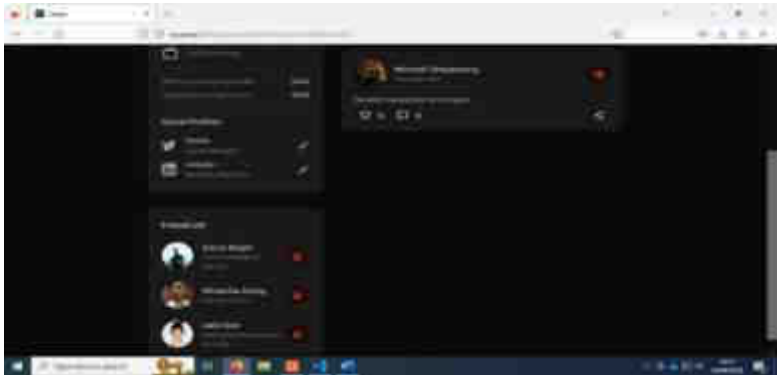

Figure 10: Profile Page. Source: Research Data, 2023

On the profile page, a component retrieves user information based on the `userId` from the URL parameters and displays it. This personalization is a crucial aspect of the user experience, as it fosters a sense of connection between the user and the platform. The use of the `useState` hook to manage user data, combined with conditional rendering, ensures that the page does not display incomplete or empty content. This is intended to deliver a seamless and coherent user experience.

Figure 11: Form Page. Source: Research Data, 2023

Figure 12: Statistics Page. Source: Research Data, 2023

On the Forms and Statistics page, the Google Forms form and Google Sheets statistics are embedded and do not follow responsive design principles.

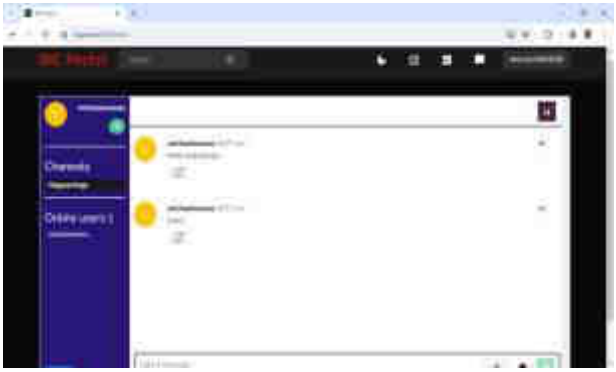

Figure 13: Chat Page. Source: Research Data, 2023

On the Chat Page, there is an embedded Dead Simple Chat interface, where a live expert can host a live event. Regular users can join the chat room using a username of their choice, while the live expert is provided with a special PIN by the Administrator to obtain moderator status.

4.4 Gray-Box Testing on the Investor Portal

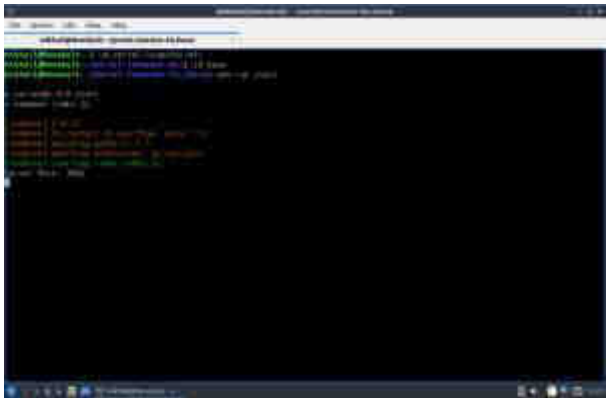

Figure 14: Positive Test on Environment Integration. Source: Research Data, 2023

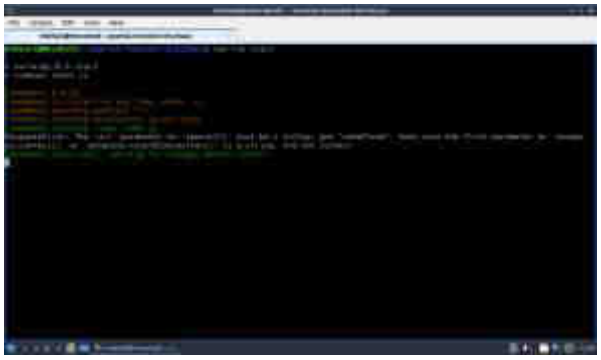

Figure 15: Negative Test on Environment Integration. Source: Research Data, 2023

In Figure 14, a positive test for environment integration demonstrates that the server has successfully connected to the database. This is indicated by the server output: “Server Port: 3001”. The output message "Server Port: 3001" signifies that the Node.js server is running and listening on port 3001. This message is typically displayed in the console as part of the server startup process or serves as a means to inform the user of the port on which the server is accessible. In Figure 15, a negative test for environment integration reveals that, in the absence of an environment file, the server output generates the following message: “MongooseError: The `uri` parameter to `openUri()` must be a string, got ‘undefined’. Make sure the first parameter to `mongoose.connect()` or `mongoose.createConnection()` is a string. Did not connect.” This error message relates to Mongoose, an Object Data Modeling (ODM) library for MongoDB and Node.js. The error indicates that the `uri` parameter—which is expected to be a string representing the connection URI for the MongoDB database—was not specified; in this instance, it appears as "undefined." This error can occur if the environment file or configuration file containing the database URI has been deleted, or if there is an issue with how the URI is being accessed or passed to Mongoose.

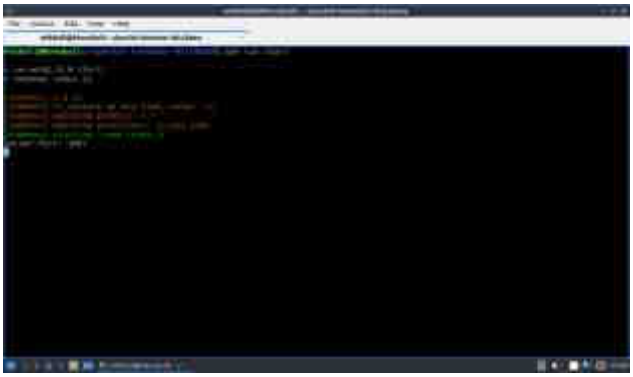

Figure 16: Positive Test on Mongoose Integration. Source: Research Data, 2023

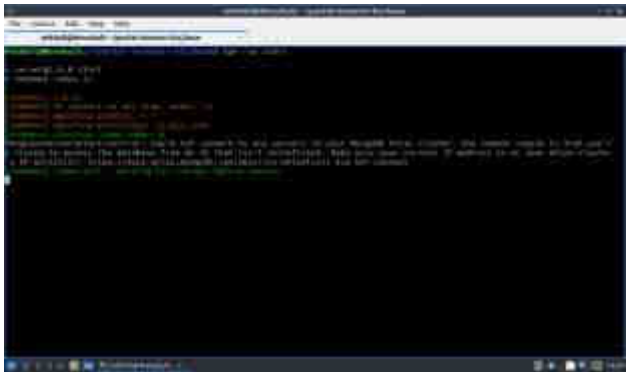

Figure 17: Negative Test on Mongoose Integration. Source: Research Data, 2023

In Figure 16, a positive test of the Mongoose integration demonstrates that the server successfully connected to the database. This is indicated by the server output: “Server Port: 3001”. In Figure 17, a negative test of the Mongoose integration shows that when the computer's IP address has not been granted access within MongoDB Atlas, the server output generates the following message: “MongooseServerSelectionError: Could not connect to any servers in your MongoDB Atlas cluster. One common reason is that you’re trying to access the database from an IP that isn’t whitelisted. Make sure your current IP address is on your Atlas cluster’s IP whitelist: https://docs.atlas.mongodb.com/security-whitelist/ did not connect”. The visible error message, "MongooseServerSelectionError," is a common error encountered when using MongoDB Atlas. It indicates that the application is unable to connect to the MongoDB Atlas cluster. The specific reason cited is that the user is attempting to access the database from an IP address that is not included in the whitelist.

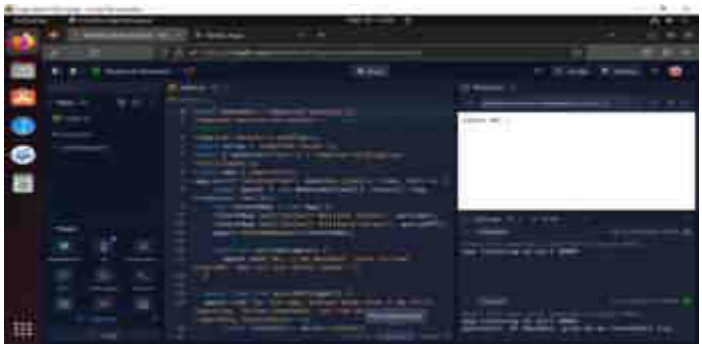

Figure 18: Replit Console for the Webhook. Source: Research Data, 2023

Figure 19: Positive Test on Intelligent Chat System. Source: Research Data, 2023

As shown in Figure 19, a positive test of the intelligent chat system demonstrates that the chat provides responses —specifically, answers—to user inquiries when the "Webhook-Novobot" program is connected to the OpenAI API. Conversely, a negative test of the intelligent chat system indicates that the chat provides no response whatsoever to user inquiries when the "Webhook-Novobot" program is not running.

4.5 UI/UX Usability Testing

In this section, present the key findings from the usability testing, organized by task.

Task 1: Registration Page

Participant 1 provided positive feedback regarding the clean and easy-to-follow layout. Participant 1 experienced smooth interaction with the registration form, and the system responded quickly. No issues were reported during the registration process. Participant 2 offered positive feedback on the clarity and simplicity of the Registration Page. The standard form design was appreciated, and the registration process was reported to be easy. A concern raised by Participant 2 involved the dominant use of the color red, particularly if it were to become overly conspicuous on other pages. Participant 3 provided positive feedback on the Registration Page's clean and easy-to-follow layout. The registration process was described as easy and fast, with a humorous reference to "a bull barging through." Participant 4 found the text on the Registration Page to be somewhat small but successfully registered after taking extra time to read it. Participant 5 considered the Registration Page to be clean and the form simple, evoking a nostalgic "space race" aesthetic. The registration process was smooth, and the simplicity of the design was highly appreciated.

Task 2: Login Page

Participant 1 formed a positive impression regarding the speed at which the login page loaded. With standard fields for username and password, no confusion was reported. The login process was user-friendly, with no issues encountered. Participant 2 offered positive comments regarding the readability of the text and the standard username/password fields on the Login Page. The login process was reported to be efficient and fast, with no issues. The standard fields on the Login Page were well-received by Participant 3, and the login process proceeded smoothly. Participant 3 jokingly referred to themselves as "an agile bull" while logging in, indicating a positive experience. The small text on the Login Page posed a challenge for Participant 4. Assistance was requested to enter credentials due to difficulties with the small text. Participant 5 noted the design consistency on the Log in Page, and the standard login fields were considered appealing. No issues were encountered during the login process.

Task 3: Home Page

Participant 1 expressed appreciation for the dark/light mode toggle, noting its value for personalization. The seamless transition between modes indicated a positive user experience. Navigation was found to be easy, and the options for posting text and images were clear. Participant 1 suggested considering the future addition of video and audio posting options. Participant 2 provided positive feedback regarding the smoothness of the transition between dark and light modes on the Home Page. The graphic designer felt that the predominantly red color scheme was somewhat intense for their personal taste, suggesting that a more balanced color palette be considered. Participant 3 responded positively to the dark/light mode toggle on the Home Page, specifically appreciating the smooth transition. They demonstrated a clear understanding of—and satisfaction with—the posting features, describing them as "easy" and "no-nonsense." Participant 4 took note of the dark mode toggle; while they found the

posting options to be clear, they noted that it would take some time to get accustomed to them. The profile page layout was perceived as clean, though navigation proved challenging, leading Participant 4 to suggest that elements be made larger or labeled more clearly. The dark/light mode toggle was appreciated by Participant 5, who described the posting features as simple and straightforward. The overall design struck them as contemporary yet possessing a retro charm, reminiscent of space-themed advertisements.

Task 4: Profile Page

Participant 1 provided positive feedback regarding the organized layout of the profile page. The visibility of posts and basic information was clear. The editing options met user expectations, with no issues reported. Participant 2 responded positively to the clean layout of the Profile Page. There were no complaints regarding the conventional profile structure or the placement of details. Participant 3 also provided positive feedback on the clean layout of the Profile Page. The participant expressed satisfaction with the editing options and metaphorically described the site as a "bull market—everything is on the rise." The clean layout of the Profile Page was acknowledged by Participant 5, and its design remains consistent with the nostalgic aesthetic. Editing was effortless, and the overall experience felt like a blend of the past with a modern touch.

Task 5: Form Page

Participant 1 provided positive feedback regarding the design, noting its resemblance to Google Forms. Concerns regarding security were raised, though assurances were provided regarding data safety. No specific issues were reported during the interaction with the forms. Functional feedback was offered by Participant 2 regarding the familiarity of the Google Forms interface. Form submission was reported to be smooth; however, concerns were raised regarding the page's left-aligned positioning, which felt disconnected from the site's overall design. Participant 3 offered a positive response to the straightforward nature of the Forms Page, specifically its Google Forms-like design. The participant likened the form submission process to "collecting fees via documentation." The use of Google Forms felt familiar, though Participant 4 expressed uncertainty as to whether the form had been filled out correctly. The left-alignment of the Forms Page was perceived as unexpected by Participant 5, yet functional, while still maintaining a sense of simplicity. Form submission was deemed remarkably easy, and the design aligned well with the overarching retrofuturistic theme.

Task 6: Statistics Page

Participant 1 provided positive feedback regarding the presentation of statistics using Google Spreadsheets. The charts were clear and easy to understand, with no complaints. Participant 1 expressed slight concern regarding the placement of the form—feeling it was positioned somewhat insecurely—but was overall satisfied with the page. Participant 2 offered positive feedback on the Statistics Page, which features embedded Google Sheets charts. They appreciated the effective data visualization and the clarity of the charts. A suggestion was made to use a more neutral color palette for data representation. Participant 3 also provided positive feedback on the Statistics Page with its embedded Google Spreadsheet charts. Participant 3 appreciated the clarity of the charts and jokingly likened them to stock market tracking, emphasizing a "bullish" perspective. Participant 4 found the Statistics Page challenging due to small text and difficulty interpreting the charts, particularly regarding the pop-up data boxes. It was suggested that simpler visuals might be more helpful. The Statistics Page—with its embedded Google Spreadsheet charts—was appreciated by Participant 5 for its simplicity and vintage aesthetic. The pop-up data boxes, which were likened to old data sheets from the Space Race era, were considered charming.

Participants in the usability test for the Bali Investment Club social investor portal largely provided positive feedback—delivered via a "think-aloud" protocol—across various aspects of the platform. The registration and login processes were praised for their clean layout and straightforward design. Although participants liked the dark/light mode toggle on the homepage and found the posting feature to be clear, some challenges were occasionally noted—such as small text hindering readability and certain features requiring some time to get used to. The profile page received positive comments for its clean layout and the clear visibility of posts; however, some users suggested the need for larger elements or clearer labeling to enhance usability.

The utilization of Google Forms on the forms page generally received positive feedback, though there were some unexpected elements—such as left-alignment—and participants emphasized the importance of readability. The statistics page, presented using Google Sheets charts, was appreciated for its clarity, although some participants suggested simplifying the visuals to facilitate better interpretation. The portal's unique retro-futuristic theme garnered a positive response, with participants expressing a sense of nostalgia and suggesting that it be promoted as a distinct selling point in marketing efforts.

Despite these positive impressions, existing challenges centered on small text size and certain features perceived as overly complex—pointing to potential areas for improvement regarding user experience. Overall, participants expressed satisfaction with the user-friendly nature of the Bali Investment Club portal, highlighting its potential—with a few minor adjustments—to further enhance readability and feature clarity.

4.6 User Acceptance Testing (UAT) by Bali Investment Club

Table 1: UAT Report from Bali Investment Club

Number of Tests Executed	33
Critical Defects	-
Major Defects	1
Minor Defects	2
Issues Resolved	-
Pass Rate	90%

Source: Research Data, 2023

Based on the User Acceptance Testing report provided by the Bali Investment Club, a total of 33 test cases were executed during the UAT phase, covering all aspects of the application. No detailed information regarding critical defects was provided. Major defects consisted of a peer dependency conflict involving 'multer v1.4.2' within 'node_modules'. Minor defects included a lack of responsive design for the "/forms" and "/stats" pages. No detailed information was provided regarding resolved issues. 90% of the test cases passed successfully.

The UAT results were presented to stakeholders from PT [PMA] Bali Investment BIC on the scheduled date. Despite the identified defects, stakeholders approved the software launch, taking into account the nature and severity of the issues. The Bali Investment Club Social Investor Portal has successfully completed the User Acceptance Testing phase. The software is deemed ready for production release—with stakeholder approval—considering the issues addressed and their impact on overall functionality.

5. Conclusion and Recommendations

5.1 Conclusion – Size 10

A web-based Investor Portal Information System utilizing OpenAI Artificial Intelligence has been designed and implemented. A Level 0 Data Flow Diagram (DFD), Level 1 DFD, and Database Entity-Relationship Diagram (ERD) have been designed. Key Performance Indicators (KPIs) have been designed to serve as metrics for companies regarding climate awareness and labor practices. User interfaces for the Login, Main, Profile, Forms, and Statistics pages have been developed for the client-side of the Bali Investment Club Investor Portal Information System. An investor portal information system for the Bali Investment Club has been developed, automated by GPT-3 and Codex intelligent agents from OpenAI.

An investor portal information system for the Bali Investment Club has been developed using a MongoDB database, the Express and ReactJS frameworks, and a NodeJS web server. The Investor Portal Information System operates optimally, having successfully undergone testing using gray-box testing—specifically regression testing focused on error scenarios—and usability testing utilizing the think-aloud protocol, which yielded predominantly positive feedback. During User Acceptance Testing, the Bali Investment Club Investor Portal Information System was deemed ready for production release, with the approval of Bali Investment Club stakeholders and with due consideration given to the issues addressed and their impact on overall functionality. This research contributes to the advancement of information technology and the "New Paradigm" initiatives within the business sector in Indonesia.

5.2 Recommendations – Size 10

Based on the research findings, the following recommendations are proposed for future development:

1. Technical Development & Artificial Intelligence

AI Model Updates: Given that the system currently utilizes GPT-3 and Codex, it is recommended to migrate to—or fine-tune—newer models (such as GPT-4o or specialized financial models) to enhance the accuracy of investment data analysis and the responsiveness of smart agents.

Database Optimization: As the volume of investor and transaction data stored in MongoDB continues to grow, it is necessary to implement advanced indexing strategies or utilize caching mechanisms (such as Redis) to maintain rapid data access speeds, particularly on statistics pages.

Expansion to Mobile Platforms: Since the current system is a web-based application built with ReactJS, the development of a native or hybrid mobile application (using React Native) should be considered to provide improved accessibility for investors with high mobility.

2. Functionality & Content Enhancements

Expansion of KPI Metrics: In addition to climate-awareness and labor-related indicators, the system could be enhanced with more comprehensive ESG (Environmental, Social, and Governance) metrics to align with international sustainability reporting standards (such as the GRI Standards).

Interactive Data Visualization: Develop the statistics features to be more interactive—for instance, by providing investment profit projection simulations or real-time dashboards integrated with external market data.

3. Security and Compliance

Periodic Security Audits: Given that the system handles sensitive investor data, it is recommended to conduct periodic Penetration Testing and implement additional security features, such as Multi-Factor Authentication (MFA).

Regulatory Compliance: Ensure that the system continuously adapts to personal data protection regulations (UU PDP) in Indonesia, as well as the regulations issued by the Financial Services Authority (OJK) regarding digital platforms for investment clubs.

4. User Experience (UX)

Feedback-Driven Iteration: Conduct periodic, advanced usability testing to capture evolving user needs once the system is operational in a production environment, with the aim of refining form workflows and user profile interfaces.

References

[1] Horner, R. (2020). Towards a new paradigm of global development? Beyond the limits of international development. Progress in Human Geography, 44(3), 415–436. https://doi.org/10.1177/0309132519836158

[2] Hong, Y. (2020). Intelligent financial development based on artificial intelligence. In Proceedings of the 2020 2nd International Conference on Applied Machine Learning (ICAML) (pp. 208–211). IEEE. https://doi.org/10.1109/ICAML51583.2020.00047

[3] Handayani, I. (2020, October 30). Indonesia kekurangan tenaga ahli artificial intelligence. *Berita Satu*.
[4] Norhikmah. (2016). Perancangan sistem informasi monitoring dosen wali menggunakan ASP.NET Signal R. *Citec Journal*, *3*(3).
[5] Piccoli, G., & Pigni, F. (2019). *Information systems for managers: With cases* (4th ed.). Prospect Press.
[6] Rochaety, E. (2017). *Sistem informasi manajemen* (3rd ed.). Mitra Wacana Media.
[7] Adh, I. G. K. G. P. W. (2016). Perancangan sistem pengolahan kuesioner penggunaan laboratorium Stikom Bali. *Jurnal Sistem dan Informatika*, *10*(2).
[8] Pasek, I. P. P. P. (2017). *Aplikasi manajemen unit kegiatan mahasiswa berbasis website menggunakan teknologi CodeIgniter dan React JS* [Unpublished undergraduate thesis/report]. STIKOM Bali.
[9] Huang, X. (2020). Research and application of node.js core technology. In *Proceedings of the 2020 International Conference on Intelligent Computing and Human-Computer Interaction (ICHCI)* (pp. 28–32). IEEE. https://doi.org/10.1109/ICHCI51889.2020.00008
[10] Chauhan, C. (2019). A review on various aspects of MongoDB databases. AIP Conference Proceedings, 8(5).
[11] Sapnarianthi, I. A. R. (2022). *Sistem informasi company profile pada PT. Tujuh Ide Menyatu berbasis website menggunakan framework Express* [Unpublished undergraduate thesis/report]. STIKOM Bali.