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Designing a Knowledge-Based Chatbot to Elevate Business Licensing Services in Indonesia

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Abstract

The business licensing process in Indonesia often faces several challenges, including lack of information, unstable system, complicated procedure, and slow response to complain. These issues can hinder economic growth and limit access for businesses. This research aims to design a knowledge-based chatbot to elevate business licensing services in Indonesia. The proposed chatbot will utilize natural language processing (NLP) technology and a structured knowledge base to provide accurate information, assist in form filling, and offer step-by-step guidance to users. This research employes a User-Centered Design (UCD) approach to ensure that the developed chatbot meets the needs and preferences of its users. The research stages involve user requirements analysis, UML design, system design, and iterations based on feedback obtained. Data will be collected through questionnaires, interviews, and literature studies. Leveraging the proposed architecture, we demonstrate how the resulting knowledge-based chatbot is expected to enhance business licensing services. The findings identified 8 key features expected in the chatbot, including real-time information access, problem reporting, business licensing guidance, a tracking system, personalized simulation, a feedback mechanism, multilingual support, and the ability to connect with a contact center agent. By implementing these features, the proposed chatbot is anticipated to significantly reduce processing times, streamline user interactions, and enhance user satisfaction by providing real-time assistance and reducing errors in form submissions. This will contribute to a more efficient licensing process, fostering economic growth and improving the business environment in Indonesia.

Keywords: *knowledge-based chatbot; business licensing; user-centered design; public services*

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1. Introduction

Reforming business licensing is crucial for strengthening the investment climate, as it can lead to increased business establishment and job creation [1]. One of the business licensing reforms implemented by the Indonesian government is the enactment of the Job Creation Law and Government Regulation No. 5 of 2021 regarding the Implementation of Risk-Based Business Licensing. These regulations have caused disruption and a paradigm shift in business licensing in Indonesia, both in terms of regulations and business processes. The objective of these regulations is to improve the investment ecosystem and ease of doing business in Indonesia [2], [3]. As a follow-up to these regulations, in August 2021, the government implemented the Risk-Based Business Licensing System (OSS-RBA). OSS-RBA is an integrated system used for risk-based business licensing and mandatory for business actors, ministries/ agencies, and local governments [2].

However, the implementation of OSS-RBA is faced with various challenges and issues. According to the contact center service activity report, during the 2023, the OSS-RBA contact center received more than 1 million interactions with the users. The common issues that arose are related to the business licensing information, issuance process of the business identification number (NIB), and information regarding the standardized classification of Indonesian business fields (KBLI) for their business. This

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indicates that business actors face difficulties in obtaining the necessary information and that there is still a low level of digital literacy among users in utilizing the OSS-RBA system.

In light of these issues, there is a growing need for innovative solutions that leverage emerging technologies to improve the business licensing experience in Indonesia. The integration of technology, specifically through the development of a knowledge-based chatbot, presents a promising solution to these issues. Chatbots, powered by natural language processing (NLP) and structured knowledge bases, can provide real-time, accurate information, assist with form filling, and offer step-by-step guidance to users. This technology has the potential to significantly improve the accessibility and efficiency of business licensing services in Indonesia. Furthermore, chatbot can significantly reduce the administrative burden on public organizations and improve communication between the government and the public regarding the provision of public services [4].

This research aims to design a knowledge-based chatbot to elevate business licensing services in Indonesia by optimizing various knowledge related to business licensing possessed by the organization. By employing a User-Centered Design (UCD) approach, this research seeks to ensure that the developed chatbot meets the needs and preferences of its users. The study involves several stages, including user needs analysis, Unified Modified Language (UML) design, system design, and iterative improvements based on feedback. This study is expected to contribute not only to academics and practitioners but also as a basis for the future development of knowledge-based chatbot in the OSS-RBA system. Therefore, the research questions in this paper are:

What features/services are expected to be included in the knowledge-based chatbot to support business licensing services?

What is the design of the business licensing knowledge-based chatbot?

User-Centered Design (UCD) is a design philosophy and process that prioritizes the needs, preferences, and limitations of end users at every stage of the design and development process [5]. It is a valuable approach in software development, with various methods and tools available to support the understanding of user and task requirements, as well as the iteration of design and evaluation [6]. UCD can be applied to any type of system, object, or product intended for human use, with the success of the design measured by user satisfaction and task completion [7].

In practice, UCD involves direct user engagement sessions to construct cognitive models and support rapid prototyping [8]. The primary goal of UCD is to create products that are both usable and useful, ensuring a positive user experience. UCD is iterative, meaning that designers repeatedly refine their designs based on user feedback [5]. Employing user-centered design ensures that the application possesses strong usability. This approach is objective and typically depends on data to inform decisions. The detailed process of user-centered design is illustrated in Figure 1.

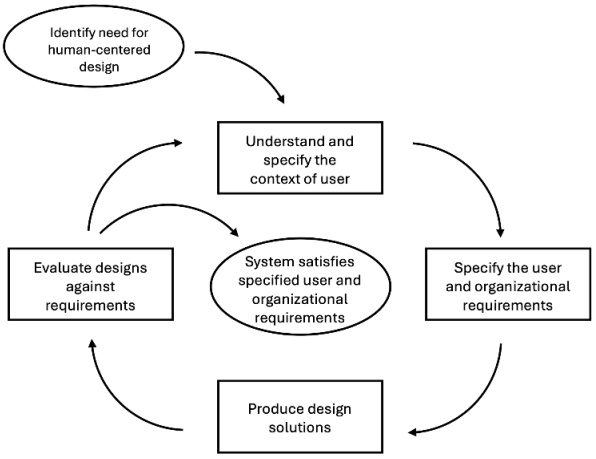

Fig. 1. User-centered design process

Unified Modeling Language (UML) is the result of consolidating best practices that have evolved over the years in the use of modeling languages [9]. UML facilitates the representation of various aspects of software systems [10]. Using UML in modeling generates graphical representations that provide diverse perspectives on the system through various diagrams, each illustrating different aspects of the model [9].

Use case diagrams are a valuable tool for understanding the behavior of existing systems and capturing user interactions [11]. They are particularly useful for describing usage scenarios and user functionality [9]. An activity diagram focuses on modeling the procedural processes within a system, organizing the flow of control and data between various steps or actions required to perform a specific activity [9]. Meanwhile, class diagrams are used to depict the static structure of a system, showing the system's elements and the relationships between them that do not change over time [9]. These diagrams facilitate the creation of a conceptual overview of the system and define the vocabulary used.

A knowledge base is a valuable tool for both customer and employee support, as it can significantly reduce support costs and increase customer satisfaction [12]. It can be designed to diagnose user problems and provide tailored information [13], and can be used to consolidate

and streamline documentation [14]. Knowledge bases are also crucial in public service, a knowledge base could inform development and implementation of policies and programs [15]. However, their effectiveness is contingent on the utility of the information and the labor required for maintenance [16]. Knowledge bases can also be used to improve company efficiency and competitive advantage [17] and have become the center of library management and discovery [18].

The rapid advancement of chatbot technology has led to its widespread adoption across various industries, including customer service, education, healthcare, and manufacturing [19]. A range of studies have explored the potential of chatbots with knowledge bases to quickly and accurately answer customer queries. Lommatzsch [20] and Hausdorf [21] both emphasize the importance of intuitive interfaces and visual methods for managing knowledge bases. Sharath [22] and Ait-Mlouk [23] propose memory-efficient and knowledge graph-based approaches, respectively, to improve the chatbot's ability to recognize and answer natural language patterns. Reshmi [24] and Matthews [25] focus on the interactivity and value-added aspects of chatbots, with Reshmi implementing an inquisitive chatbot and Matthews discussing the use of structured knowledge organization systems. Lastly, Makhalova [26] and Sharath [22] both present models for conversational question answering, with Makhalova's model incorporating a concept-based knowledge model and Sharath's model using an ensemble of entity recognition, prediction, and question-answering models.

2. Research Methods

This section describes the steps taken in this research. The workflow of this research can be seen in Figure 2. This research is conducted through several interconnected main stages to achieve the predetermined goals consisting of data collection and gathering, data analysis, system design, and validation and evaluation.

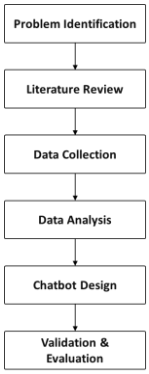

Fig. 2. Research methodology

Problem Identification: The research begins by identifying key issues with the current OSS-RBA system, such as difficulties in accessing business licensing information and low digital literacy among users. The research aims to address these challenges by designing a chatbot to improve the user experience and efficiency of business licensing services.

Literature Review: Following the problem identification, a thorough literature review is conducted. This step involves examining existing studies and technologies related to chatbots, NLP, and business licensing systems. This helps in understanding the current state of technology and identifying gaps that the proposed chatbot can fill.

Data Collection: The data collection phase involves multiple methods to ensure a thorough understanding of user needs, system requirements, and the existing challenges in the business licensing process. Interviews were conducted with key stakeholders, including representatives from the Ministry of Investment/BKPM, regional licensing offices, and business associations. In addition, a document analysis was also conducted from several sources such as document reports, regulations, and guidelines related to business licensing in Indonesia.

Data Analysis: Collected data is analyzed to identify key user needs and challenges in the licensing process. Insights from the analysis guide the chatbot design and the structuring of the knowledge base. The analysis will guide the development process by highlighting the most critical areas of focus and ensuring that the chatbot's features address the problems and meet the user's needs.

Chatbot Design: The development of the knowledge-based chatbot followed a UCD approach, ensuring that user needs and preferences were at the core of the design process. This approach involved continuous interaction with users throughout the development stages. Rapid Application Development (RAD) was employed to speed up the development cycle, utilizing a prototyping methodology. The prototyping method was selected because the objectives and anticipated outcomes of this study involve the creation of a knowledge base chatbot prototype. Prototyping is particularly well-suited for knowledge base chatbot design, due to its iterative and responsive development process [27].

Within this methodology, analysis, design, and implementation occur concurrently in iterative cycles until the system is finalized. This allows users to interact with system prototypes early on, even before the system is ready for full-scale organizational deployment. Prototypes provide users and project sponsors with opportunities to offer feedback, which is then incorporated into subsequent prototype iterations for

refinement and enhancement [28]. This iterative process ensures that the prototype aligns more precisely and accurately with user requirements.

Once user needs are identified, UML diagrams, such as use case diagrams, activity diagrams, and class diagrams, are created to model the interactions between the chatbot and its users, as well as define the internal structure of the system. The use case diagram outlines the core functions of the chatbot. The activity diagrams are used to visualize the step-by-step flow of key processes. Meanwhile, class diagrams define the structural relationships between the system components, ensuring modularity and clarity in design.

Validation and Evaluation: The final phase involves validating and evaluating the proposed knowledge-based chatbot design to ensure it meets the specified requirements. This process will be conducted through in-depth interviews with several users, including representatives from ministries and agencies, local governments, and business actors.

3. Results and Discussions

This section presents the findings from our research and the analysis of the data collected during the development of the knowledge-based chatbot aimed at enhancing business licensing services in Indonesia. By utilizing UCD approach, we gathered insights through in-depth interviews and questionnaires from various stakeholders, including business actors and government officials.

Our analysis identifies the core issues users face with the current OSS-RBA system and highlights the specific requirements for an effective chatbot solution. The proposed features are designed to address these challenges and improve the overall user experience. Following the identification of key features, the authors developed UML diagrams and prototypes for the chatbot. The designed UML diagrams and prototypes were then subjected to validation and evaluation by users to ensure that the proposed design aligned with their needs and expectations. The authors utilized user feedback to refine and enhance the chatbot design, ensuring that the final design met the requirements and preferences of the users.

3.1 Features of The Proposed Knowledge-Based Chatbot

Despite the implementation of the OSS-RBA system aimed at streamlining business licensing processes, users continue to face difficulties in navigating the system, understanding regulatory requirements, and obtaining timely assistance. This research is conducted using a UCD approach, so in addition to conducting report and document studies, the authors also perform in-depth interviews and distribute questionnaires to obtain stronger justification for the problems faced by users. Table 1 shows some common issues encountered by users when handling business licensing using the OSS-RBA.

Table 1. Common Issues

No	Issues
1	Lack of information
2	Unstable system
3	Slow response to complaints
4	Complicated procedure

Besides that, the authors also conducted an analysis of the requirements for the knowledge-based chatbot to be developed, based on the results of the distributed questionnaires and conducted interviews. Table 2 represents the user requirements for the chatbot.

Table 2. User Requirements

No	Requirements
1	Provides comprehensive information on licensing requirements
2	Offers step-by-step guidance for the licensing process
3	Assists in filling out licensing forms
4	Answers questions and resolves licensing-related issues accurately and in real-time
5	Available in two languages: Indonesian and English
6	Recording unresolved issues as tickets that need to be addressed

Based on the issues and requirements shown in Table 1 and Table 2, the authors then conducted an analysis and formulated the proposed features in the knowledge-based chatbot, which are expected to address the problems and meet the user's needs as shown in Table 3.

Table 3. Proposed Features

No	Features	Brief Description
1	Real-time Information Access	Offering up-to-date information on regulations, procedural requirements, and other related business licensing information.
2	Report problem	Users can report issues they encounter within the OSS-RBA system.
3	Business licensing guidance	The chatbot offers step-by-step guidance to assist users in completing their licensing applications.
4	Tracking system	Users will be able to check the status of their applications and receive updates on any actions required.
5	Personalized simulation	The chatbot provides tailored business licensing simulation based on the user’s specific business context and requirements.
6	Feedback mechanism	The chatbot collects user feedback to continuously improve its performance and accuracy.

No	Features	Brief Description
7	Multilingual support	The chatbot is available in both Indonesian and English
8	Able to connect with contact center agent	Allows users to seamlessly escalate their inquiries or issues from the chatbot to a live contact center agent.

The proposed chatbot features were then validated with three OSS-RBA users representing business actors, ministries/agencies, and local governments. All three users agreed that the features aligned with their expectations and needs. These key features were then used as a reference for further UML and architecture design.

3.2 UML Design of The Proposed Knowledge-Based Chatbot

This sub-section explores the UML design of the proposed knowledge-based chatbot, detailing the key components and their interactions. The UML design will encompass various diagrams, including use case, activity, and class diagrams.

Based on the analysis of requirements and the proposed features, the authors then created a use case diagram for the proposed chatbot. Seven actors were identified, consisting of five human actors—user, business actor, government agencies, citizens, and contact center agents—and two system actors—the OSS-RBA system and the CRM system. The use case diagram consists of seven use cases, including accessing business license information, providing application submission guidance, tracking application status, simulating the business license process, reporting issues, resolving business license issues, and giving feedback

The knowledge-based chatbot is aimed at supporting business licensing services. This chatbot enables different users to interact with the system for various licensing-related needs. The primary functionalities of the chatbot include providing access to business license information, guiding users through application submission, tracking application status, and simulating the business license process to help users understand the steps involved.

The chatbot also assists users in reporting issues they encounter. These reports are managed via an integrated CRM system for efficient handling and resolution. For more complex cases, the chatbot includes a resolve business license issues function, which may connect users to a contact center agent for personalized assistance. Additionally, users can give feedback on the services they receive, which helps improve the chatbot's performance over time. The chatbot interfaces with the OSS-RBA system, allowing it to provide accurate and up-to-date licensing information directly from the central platform. Through this design, the chatbot aims to streamline the business licensing process, enhance user experience, and facilitate faster issue resolution.

In the previous section, we explained that the proposed chatbot comprises seven use cases. In this section, we will illustrate the activity diagram for a specific use case, namely reporting issues. This use case was selected based on the results of the distributed questionnaires, which indicated that the need for accurate and real-time problem resolution was one of the top two requirements identified, alongside the need for comprehensive licensing information.

The activity diagram shows the process of asking questions and reporting issues through a knowledge-based chatbot system, integrating with a CRM system and involving contact center agents when necessary. The process begins with the user opening the chatbot and selecting the interaction type, either choosing a common issue from a list or typing a custom question.

Once a question or issue is submitted, the chatbot processes and interprets it using NLP. It then searches for a suitable response in the knowledge base. If a relevant answer is found, it is displayed to the user. The user can provide feedback on the answer, indicating whether they are satisfied or not. If the user is unsatisfied, they may ask for clarification or choose to escalate the issue to a contact center agent.

If no answer is found in the knowledge base, or if escalation is requested, the CRM system opens a ticket. A contact center agent is then assigned to address the issue, providing a personalized answer to the user. Finally, any new answers provided are stored in the knowledge base for future reference, continuously improving the system's responsiveness.

Class diagrams illustrate the objects within a system and the relationships between those objects. The class diagram shows the relationships and interactions among four main classes: User, Chatbot, Issue, and History. User Class has attributes like userId (varchar) and userType (varchar) and includes methods such as askQuestion(), reportIssue(), trackApplication(), and giveFeedback(). The User class has a one-to-many relationship with the Issue class, indicating that a user can report multiple issues. Chatbot Class has attributes like id (varchar), language (varchar), and message (varchar). It provides methods such as receiveMessage(), sendMessage(), processRequest(), and escalateIssue(). The Chatbot class is associated one-to-one with the User class.

Issue Class has attributes issueId (varchar), description (varchar), status (varchar), and userReportedId (varchar). It includes methods like createTicket(), resolveIssue(),

and assignTicket(). The Issue class is related to the User class, where one user can report multiple issues. History Class has attributes such as historyId (varchar), createdAt (timestamp), userId (varchar), message (varchar), and closedAt (timestamp). It includes methods like getMessage() and getUserId(). The History class has a relationship with the User class, indicating that a user can have multiple history entries.

The relationships highlight interactions among the classes, where User and Chatbot initiate or respond to issues, while History keeps track of the events associated with each issue and user.

3.3 Architecture and Prototype Design of The Proposed Knowledge-Based Chatbot

Before full-scale implementation, it is essential to develop a robust architecture and prototype for the proposed knowledge-based chatbot. This section outlines the foundational structure and initial prototype design, ensuring that the chatbot can seamlessly integrate with existing systems and meet the identified user requirements.

The architecture of the proposed chatbot is designed to support real-time interactions, accurate information retrieval, and efficient issue resolution as shown in Figure 3. It integrates various components, including NLP engines, knowledge base, and interfaces with the OSS-RBA and CRM systems. This integrated approach ensures that the chatbot can provide comprehensive, up-to-date information and personalized assistance to users.

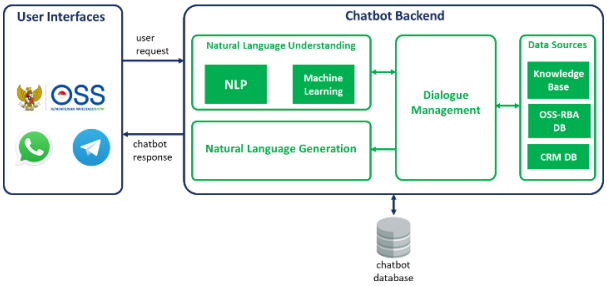

Fig. 3. Proposed Architecture Design

User Interfaces represent the user's interaction point with the chatbot system. The authors propose 3 channel to interact with the chatbot, including OSS-RBA system, WhatsApp and Telegram. A user's request delivered to one of the channels initiates the process. The natural language understanding (NLU) parses the user request after it is received by the chatbot to determine the user's intention and the relevant information [29]. NLU aids in classifying intents, extracting entities, and understanding user input and queries. It consists of two sub-modules: machine learning (ML) sub-modules and NLP sub-modules. The text input can be cleaned up and encoded into a numeric vector representation using the NLP submodule so that machine learning algorithms can work with it. The purpose of the ML submodule is to choose a response from a list of candidates after converting the user query into structured data [30].

A low-fidelity prototype emphasizes the application's flow and copywriting. Additionally, it focuses on applying interaction design principles to a chatbot [31]. Examples of several low-fidelity prototype interfaces are displayed in Figure 4.

Fig. 4. Low-fidelity prototype interface examples

This low-fidelity prototype design provides a general overview of how a knowledge-based chatbot can be used to enhance business licensing services. With a clear flow and simple navigation options, users can easily understand and utilize the features provided by the chatbot.

The high-fidelity prototype design presented here illustrates the user interface and functionality of a knowledge-based chatbot aimed at enhancing business licensing services in Indonesia. This prototype provides a detailed and interactive representation of how the chatbot will function, closely resembling the final product in terms of design, layout, and navigation.

The initial screen greets users and introduces them to the OSS (Online Single Submission) Virtual Assistant, Tanya BOSS, as shown in Figure 5. It invites users to select their preferred language and navigate through the main menu options relevant to their needs. Upon selecting the menu options, users are provided with detailed instructions. This feature ensures users feel guided and supported throughout their interaction.

This high-fidelity prototype effectively demonstrates the chatbot's user-friendly design and functionality. It emphasizes a seamless user experience by providing clear navigation, detailed information, and responsive interaction. The prototype serves as a crucial step toward the final implementation, allowing for user feedback and

further refinements to ensure the chatbot meets the needs of business licensing services in Indonesia.

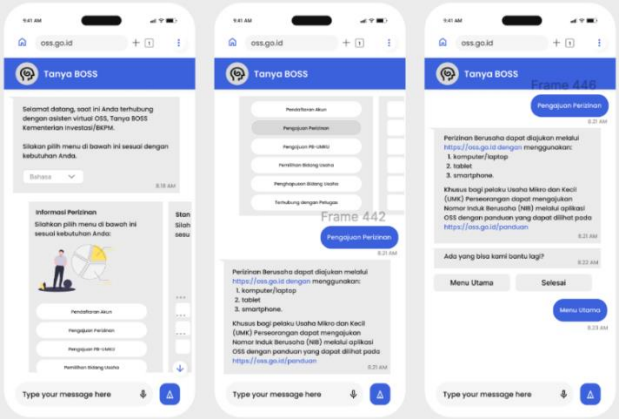

Fig. 5. High-fidelity prototype interface examples

3.4 Validation and Evaluation

The evaluation and validation process of the proposed knowledge-based chatbot design was conducted through in-depth interviews with 3 experts in the Deputy of Information Technology at the Ministry of Investment, who have experience in handling cases in the OSS-RBA system. This was intended to ensure that the proposed design meets all requirements and addresses existing issues. Based on the evaluation and validation results, the proposed knowledge-based chatbot design meets the expected criteria. The validation and evaluation results can be seen in Table 4.

Table 4. Validation Result

Respondent	Experience	Feedback
Director of Data and Information	>20 years	Utilizing incoming complaint data to enrich the chatbot's knowledge base. IT innovation, knowledge utilization, and the chatbots are essential to reduce dependence on humans.
Middle management	>10 years	The chatbot interactively provides information on what steps should be taken based on the current licensing status.
System Information Analyst	<10 years	The chatbot can read the user's position within the system and provide recommendations based on the current position. For example, if the user is currently accessing the requirements fulfillment page, the chatbot will provide information and guidance related to the requirements fulfillment process.

These insights validate the functionality of the chatbot, confirming its ability to provide real-time assistance, tailored user experiences, and context-specific guidance, which are essential for improving business licensing services.

3.5 Discussion

A chatbot with a knowledge base can tap into a vast repository of data, efficiently finding the relevant piece of information based on the received prompt and answering customer queries within seconds [21]. This capability allows the chatbot to provide accurate and timely responses, enhancing customer satisfaction and streamlining service processes [20], [21]. By leveraging a comprehensive knowledge base, the chatbot can handle a wide range of questions and issues, reducing the need for human intervention and significantly improving operational efficiency [22], [24]. Furthermore, the chatbot can continuously learn and update its database from interactions, ensuring that it remains up-to-date and capable of addressing evolving customer needs [24]. This integration of advanced technology not only improves the user experience [25] but also provides businesses with valuable insights into customer behavior and preferences, enabling them to tailor their services more effectively [22], [23].

The implementation of a knowledge-based chatbot for business licensing services in Indonesia not only addresses specific user challenges but also carries broader implications for economic growth and the overall business environment. As identified in the results, key issues such as lack of information, complicated procedures, and slow response times significantly hinder the efficiency of the licensing process. By providing real-time assistance and simplifying user interactions, the chatbot can effectively mitigate these challenges, leading to a more streamlined and efficient licensing experience.

One of the major implications of this chatbot is its potential to enhance user satisfaction among business owners. By offering accurate and readily accessible information, the chatbot empowers users to navigate the licensing process with confidence, reducing the time spent on inquiries and form-filling. This improvement can lead to increased compliance with licensing requirements, fostering a more transparent business environment where users can operate more effectively.

4. Conclusions

In this research, we designed a knowledge-based chatbot aimed at improving business licensing services in Indonesia. By leveraging the User-Centered Design (UCD) approach, we ensured that the developed chatbot met the specific needs and preferences of its users. Our process included several critical stages: user needs analysis, Unified Modified Language (UML) design,

system design, and iterative improvements based on user feedback. Based on the research results and analysis, the development of a knowledge-based chatbot to enhance business licensing services in Indonesia has shown promising outcomes. Several key issues were identified with the current OSS-RBA system, including a lack of information, unstable system performance, slow response to complaints, and complicated procedures. By adopting a User-Centered Design (UCD) approach, the research identified the needs and preferences of users, leading to the development of a chatbot prototype that addresses these issues effectively. The high-fidelity prototype of the chatbot offers a user-friendly interface and functionality that aligns with user expectations. The chatbot provides comprehensive information on licensing requirements, step-by-step guidance, assistance with form filling, real-time answers to questions, and supports both Indonesian and English languages. The iterative design process, involving feedback from users, ensured that the final prototype met the requirements and improved the user experience. However, there are limitations to the current prototype, which remains at a high-fidelity stage and has yet to be implemented as a fully functional system. Future work should focus on developing a fully operational system that includes in-depth usability testing, ensuring the chatbot's performance in real-world scenarios. Additionally, employing the System Usability Scale (SUS) for more comprehensive evaluation will provide detailed insights into user satisfaction and the system's effectiveness for public service applications. Furthermore, broader implications of this research suggest that the implementation of a knowledge-based chatbot could significantly enhance business licensing efficiency. By reducing processing times, improving access to required information, offering real-time assistance, and minimizing errors in form submissions, the chatbot could streamline public service delivery, reduce human intervention, and promote a more efficient business environment. This study establishes a basis for future advancements in integrating AI-driven solutions within public service platforms, setting the stage for further innovation and improvements in e-government services.

Acknowledgements

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