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ONLINE STORE INTEGRATION WITH INTELLIGENT CHATBOT AND SEMANTIC-BASED PRODUCT SEARCH TO IMPROVE SERVICES

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Abstract

The integration of online stores with chatbots is something that must be done so that chatbot answers are able to customize customer needs. Semantic-based product search is done to find products according to the context sought so that it will help customers find their products. The integration between online stores with intelligent chatbots and semantic-based search can significantly improve the user experience in online shopping. An intelligent chatbot assists users in finding products quickly, providing relevant product information, and addressing customer queries or concerns directly. Semantic-based search allows users to find products more accurately based on their context and preferences. The integration of online stores with intelligent chatbots and semantic-based search has great potential to improve services in the context of e-commerce. The cosine similarity method is used to give weight to each search result obtained, so that the search results obtained are more relevant to the keywords. Testing using the precission method to calculate the relevance value of the results obtained from the ontology, while testing with kappa statistics is used to calculate the value of the cosine similarity results by comparing the results obtained from the system and the results according to expert observations, it is expected that semantic-based product search is able to find products with a precision level of 98% so that customers will be satisfied.

Keywords: *Integration, Online Store, Chatbot, Product Search, Semantics*

1. INTRODUCTION

Rapid advancement of e-commerce has revolutionized the way consumers interact with businesses, creating a demand for more sophisticated and seamless shopping experiences. As online stores grow in popularity, consumers expect not only convenience but also personalized services that enhance their overall experience. The integration of intelligent chatbots and semantic-based product search has emerged as a powerful solution to meet these demands, offering businesses the opportunity to improve customer service, streamline operations, and increase sales. Intelligent chatbots have evolved significantly in recent years, moving beyond simple question-answer bots to becoming highly interactive and capable virtual assistants. Powered by natural language processing (NLP) and artificial intelligence (AI), modern chatbots can understand and interpret user queries in a more human-like manner. This allows them to offer personalized recommendations, answer complex customer queries, and even assist in completing purchases (Emizentech, 2023). For e-commerce platforms, the adoption of chatbots has several key benefits. First, they provide 24/7 customer support, allowing businesses to assist customers around the clock without the need for human agents. This reduces

operational costs while maintaining a high level of customer service. Additionally, chatbots can handle multiple inquiries simultaneously, effectively scaling the customer service function during peak times, such as sales events (GetInData, 2023).

Chatbots also play a critical role in enhancing customer engagement. By interacting with customers in real-time, they can guide users through the buying process, offer product recommendations based on browsing history or preferences, and even help resolve issues such as tracking orders or processing returns. This level of interactivity not only improves customer satisfaction but also boosts conversion rates by reducing cart abandonment (Bloomreach, 2023). Traditional product search engines in e-commerce rely on keyword matching, often leading to inaccurate or irrelevant search results. As a result, customers may struggle to find the products they are looking for, leading to frustration and lost sales. Semantic-based search addresses this issue by understanding the context and intent behind a user's query, providing more accurate and relevant results (Towards AI, 2023). Semantic search engines use advanced techniques such as machine learning, natural language understanding (NLU), and ontology-based frameworks to decipher the meaning of search terms. For instance, if a user searches for "affordable running shoes for flat feet," a semantic search engine will not only look for products that match the exact keywords but will also consider synonyms, product attributes, and user intent. This allows it to return more targeted results, improving the overall search experience for the customer (Afandi et al., 2023).

Furthermore, semantic search enhances product discoverability by providing auto-suggestions and faceted search options that help users refine their search results. This increases the chances of users finding exactly what they need, even if they start with vague or incomplete queries. As a result, businesses that implement semantic search engines report higher engagement rates and improved sales performance (Bloomreach, 2023). Integrating chatbots with semantic-based product search represents a significant advancement for online stores. When combined, these technologies create a holistic customer service experience, allowing for seamless interactions between users and the platform. A chatbot equipped with semantic search capabilities can understand complex queries and provide relevant product suggestions or information, creating a more intuitive shopping experience (GetInData, 2023). For example, a chatbot can assist a user in finding a product by engaging in a multi-turn conversation to gather more details about their preferences. Rather than simply returning a list of products based on keywords, the chatbot can refine its recommendations by understanding the user’s intent and preferences, such as budget, brand preferences, or specific product features (Towards AI, 2023). This integration not only improves the accuracy of product recommendations but also enhances the user experience by reducing the effort required to find desired products.

Additionally, AI-driven chatbots can leverage data from past interactions and purchase histories to offer personalized recommendations, helping customers discover products they may not have initially searched for. This capability is especially valuable for driving upselling and cross-selling opportunities, as the chatbot can suggest complementary products or higher-end alternatives that align with the customer's preferences (Emizentech, 2023). From a business perspective, integrating chatbots and semantic search improves operational efficiency and enhances the customer support system. By automating routine inquiries and providing real-time responses, chatbots reduce the workload for human agents, allowing them to focus on more complex customer

issues. This not only cuts costs but also leads to faster response times, improving the overall quality of service (Bloomreach, 2023). Moreover, businesses that invest in AI-powered search and chatbot integration see measurable improvements in key performance metrics. According to recent studies, companies that implement these technologies experience higher customer retention rates, increased sales, and greater customer satisfaction. In a competitive e-commerce landscape, where customer experience is a major differentiator, these tools provide businesses with a significant advantage (Afandi et al., 2023).

Despite the clear benefits, the integration of chatbots and semantic search comes with challenges. Ensuring seamless communication between the chatbot and the search engine, as well as maintaining data privacy, are critical concerns that must be addressed. Additionally, ongoing improvements to AI models and natural language understanding are necessary to keep pace with evolving customer preferences and behaviors (GetInData, 2023). The integration of intelligent chatbots and semantic-based product search in online stores is transforming the way businesses interact with customers. By enhancing the precision of search results and providing real-time, personalized assistance, these technologies help improve the overall shopping experience, leading to higher customer satisfaction and loyalty. As AI and machine learning technologies continue to evolve, the future of e-commerce will likely see even more sophisticated implementations of chatbots and semantic search, offering businesses new ways to engage with their customers and optimize their operations.

2. LITERATURE REVIEW

2.1. Intelligent Chatbots in E-Commerce

2.1.1. Evolution of Chatbots in E-Commerce

The role of chatbots in e-commerce has grown significantly in recent years, fueled by advancements in Natural Language Processing (NLP) and Artificial Intelligence (AI). Chatbots now serve as virtual customer assistants, providing real-time responses to customer inquiries, automating routine tasks, and offering personalized product recommendations (Emizentech, 2023). This evolution is a direct result of improvements in NLP, which allow chatbots to understand and process human language more accurately, moving beyond simple rule-based interactions to AI-driven conversations.

For example, AI-powered chatbots like those used by leading online platforms employ machine learning algorithms to learn from customer interactions and provide increasingly relevant responses over time. Studies have shown that intelligent chatbots can improve customer engagement, reduce shopping cart abandonment, and enhance overall customer satisfaction (Afandi et al., 2023). Additionally, chatbots are instrumental in scaling customer service, handling multiple requests simultaneously and offering 24/7 availability, a key advantage in today's globalized market (Gnewuch et al., 2017).

2.1.2. Personalized Customer Service Through Chatbots

The use of chatbots extends beyond basic customer service to delivering personalized experiences. By analyzing customer data—such as browsing history, previous purchases, and behavioral patterns—chatbots can offer tailored

recommendations and assist customers in navigating online stores more efficiently (Ghorbani, 2020). This personalized interaction enhances the customer's shopping journey, which is especially important in competitive e-commerce environments where customer loyalty is crucial for sustained success.

A notable example of this can be found in the study conducted by Afandi et al. (2023)**,** where chatbots were integrated into an online store to provide virtual customer service. The chatbot was not only capable of answering frequently asked questions (FAQs) but also utilized ontology **t**o expand its knowledge base, allowing it to answer more complex queries by interpreting the broader meaning of words. This advancement in chatbot intelligence significantly reduced response times and improved customer satisfaction.

2.2. Semantic-Based Product Search in E-commerce

2.2.1. Limitations of Traditional Search Engines

Traditional search engines used in e-commerce platforms often rely on keyword-based search mechanisms, which have limitations when it comes to understanding user intent. These systems can struggle to process complex or ambiguous queries, often returning irrelevant or incomplete search results. For instance, a search for "comfortable shoes for standing all day" might yield results based solely on the presence of keywords like "shoes" and "comfortable," without considering the specific context of long periods of standing (Afandi et al., 2023).

This is where semantic search engines come into play. Semantic search leverages Natural Language Understanding (NLU) to interpret the meaning behind search queries, making it possible to understand user intent and deliver more relevant results (Bloomreach, 2023). Semantic search systems utilize ontologies and knowledge graphs to create relationships between words and concepts, which allows for more accurate product matches even when user queries are vague or nuanced (Hu et al., 2020).

2.2.2. Advancements in Semantic Search

The integration of semantic-based product search in e-commerce has proven to be a major improvement over traditional keyword searches. By understanding the relationships between products and the context in which they are being searched, semantic search engines can offer personalized search results that align closely with a customer's intent. This approach has been shown to improve conversion rates and customer satisfaction, as users are more likely to find products that meet their specific needs without excessive browsing (Hu et al., 2020).

Research by Gnewuch et al. (2017) highlights the benefits of combining semantic search with machine learning algorithms. These systems continuously learn from user behavior, refining the search process over time to deliver increasingly relevant results. This not only enhances the user experience but also drives higher engagement and sales for e-commerce platforms.

2.3. Integration of Intelligent Chatbots and Semantic Search

The combination of intelligent chatbots with semantic-based search represents a significant opportunity for e-commerce platforms to streamline the customer experience. Chatbots with semantic search capabilities can engage in multi-turn conversations,

refining user queries through dialogue to deliver more accurate and contextually relevant product recommendations (Adamopoulou & Moussiades, 2020). This integration enhances the interaction between the user and the online store, allowing for a more intuitive and satisfying shopping experience.

For instance, semantic-enhanced chatbots can assist customers by narrowing down product options based on preferences such as price range, product features, or specific needs (e.g., shoes for hiking or formal events). This level of detail improves the precision of product recommendations and reduces the effort required by users to find suitable products, ultimately leading to better customer satisfaction and increased sales (Emizentech, 2023).

2.3.1. Business Impacts of Integration

From a business perspective, the integration of chatbots and semantic search offers numerous advantages. Ghorbani (2020) found that such integration leads to more effective customer support, faster response times, and improved user satisfaction. Moreover, by automating routine queries and offering personalized assistance, businesses can reduce the burden on human agents, thus cutting operational costs.

Additionally, semantic-based search systems are highly adaptable, meaning they can be customized for different business contexts and industries. This makes the technology scalable, allowing e-commerce platforms of varying sizes to implement these systems and benefit from their efficiency (Bloomreach, 2023). As these technologies continue to evolve, businesses are likely to see even greater returns on investment, with the potential for further enhancements in AI-driven personalization and real-time customer interactions.

3. RESEARCH METHODS

The research methodology describes the steps undertaken to design, develop, and evaluate the integration of intelligent chatbots with an online batik store using semantic product search. The flow of the research follows a logical progression as illustrated in the process diagram, from data collection and system integration to natural language processing (NLP) and evaluation.

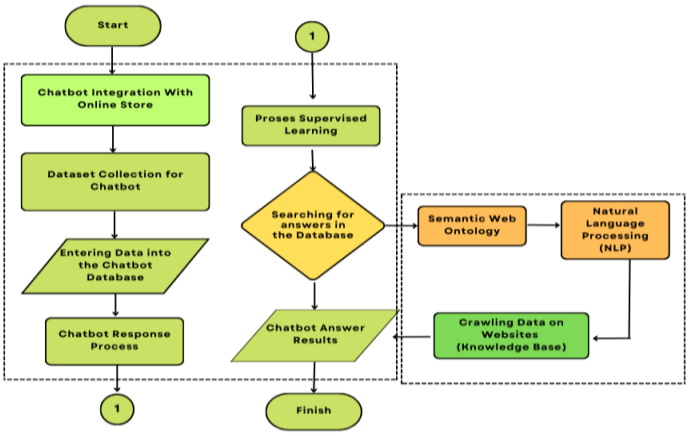

Figure 2. Chatbot integration and semantic search

3.1. Chatbot Integration with Online Store

The first phase involves integrating a chatbot system with the online batik store. This step focuses on setting up a communication interface where users can interact with the chatbot to inquire about products, ask questions, and receive responses in real-time.

a. Tools & Techniques: REST APIs will be used to connect the chatbot system with the online store's backend. The chatbot will be embedded into the store's website and mobile app for easy access.
b. Goal: To allow seamless user interaction and facilitate quick product searches and recommendations.

3.2. Dataset Collection for Chatbot

In this phase, product data from the batik store is gathered. The dataset includes information such as:

a. Product names
b. Descriptions
c. Categories
d. Prices
e. Reviews
f. Keywords related to product attributes (e.g., patterns, materials, and regions).
g. Data collection involves scrapping and organizing information from the store's existing databases.
h. Data Sources: The product data from the batik store's website and internal databases.

3.3. Entering Data into the Chatbot Database

Once the dataset is collected, the information is entered into the chatbot database. The chatbot will rely on this structured data to provide relevant responses to user queries.

a. Storage: The data is stored in a relational database optimized for quick querying by the chatbot engine.
b. Processing: The data will be processed and indexed to ensure fast and accurate product search results based on user queries.

3.4. Chatbot Response Process

In this stage, the chatbot responds to user queries by fetching data from its database. This involves querying the stored product information and providing intelligent responses or recommendations.

– Technology: A rule-based or machine learning model can be used for generating chatbot responses based on the structured dataset.

3.5. Supervised Learning Process

Supervised learning techniques will be employed to improve the accuracy of responses. This involves training machine learning models using labeled data to help the chatbot understand user intents and provide relevant answers.

a. Training Data: Includes historical customer interactions, product descriptions, and correct responses (supervised learning).
b. Algorithm: Algorithms such as decision trees, random forests, or neural networks can be utilized to classify and predict product recommendations based on the user's query.

3.6. Searching for Answers in the Database

During user interaction, the chatbot queries the dataset stored in the database to find the most relevant product information. The search process is guided by both keyword matching and semantic understanding.

– Search Methodology: The system uses natural language processing (NLP) to identify the meaning behind user queries, even when they don't match exact keywords.

3.7. Semantic Web Ontology

The system integrates a Semantic Web Ontology to improve the search results and chatbot responses. This ontology includes relationships between different products, categories, and attributes, allowing the chatbot to make more accurate and context-aware recommendations.

a. Ontology: A formal framework that represents the relationships between different elements such as product categories, patterns, colors, and other related attributes.
b. Purpose: To enhance the product search process by enabling the chatbot to understand the context and meaning of user queries.

3.8. Natural Language Processing (NLP)

Is employed to process user input, identify key terms, and provide meaningful responses. NLP enables the system to handle varied user queries more effectively.

a. NLP Techniques: Tokenization, lemmatization, and named entity recognition (NER) will be applied to analyze user input.
b. Objective: To improve the chatbot's understanding of colloquial language, synonyms, and varied ways of asking for products.

3.9. Crawling Data on Websites (Knowledge Base)

In addition to the product data, the system will crawl external websites to enrich its knowledge base with related batik information (e.g., trends, new designs, historical or cultural relevance of certain patterns).

a. Web Scraping: Data from external sources (e.g., blogs, competitor websites) will be crawled and incorporated into the system's knowledge base.
b. Data Integration: The crawled data will be processed and stored in the knowledge base to improve the chatbot’s ability to answer more complex queries.

3.10. Chatbot Answer Results

Based on the user input, semantic search, and NLP processing, the chatbot generates responses. The accuracy of these responses is continually improved through machine learning models trained in the supervised learning phase.

a. Response Evaluation: User feedback will be collected to assess the accuracy and helpfulness of the chatbot's responses.

b. Performance Metrics: Metrics such as response time, accuracy of product recommendations, and user satisfaction will be tracked.

4. RESULTS AND DISCUSSION

This section presents the results of the integration of an intelligent chatbot and semantic-based product search in an online store, specifically evaluating how these innovations impact customer service, user experience, and product discovery. The results are discussed in terms of system performance, precision testing is conducted to evaluate the results of the corresponding product search.

4.1. ALICE Database Structure

The ALICE (Artificial Linguistic Internet Computer Entity) database structure is fundamental to the functioning of the ALICE chatbot, which is based on the AIML (Artificial Intelligence Markup Language).

Figure 3. ALICE Database Chatbot

4.2. Product Search Keywords

To identify keyword patterns in a chatbot using the AIML (Artificial Intelligence Markup Language) standard within the ALICE database, the process involves analyzing how specific keywords are structured and utilized in the chatbot application. The goal is to map these patterns to corresponding templates that yield relevant responses. For effective chatbot adoption, this requires employing a method that recognizes and learns the keywords used by users during interactions, refining the response system accordingly.

Table 1. Online store product search keywords

No	Pattern	Template	Recommendation
1	batik tulis	<srai> batik tulis asli </srai>	batik Sekar Jagad
2	* batik tulis	<srai>batik Sekar Jagad</srai>	batik Gajah Oling
3	batik tulis *	<srai> batik Gajah Oling</srai>	batik Panji Kudal
4	* batik tulis *	<srai> batik Panji Kudal</srai>	batik Gringsing
5	* batik tulis *	<srai> batik Gringsing</srai>	batik Buketan
6	motif batik	<srai> Buketan</srai>	bungaDaun Simbar Menjangan
7	* motif batik	<srai> Daun Simbar Menjangan </srai>	Simbar
8	motif batik *	<srai> Kawung </srai>	Kawung
9	* motif batik *	<srai> Cinde </srai>	Cinde
10	* motif batik *	<srai> bunga </srai>	bunga

4.3. SPARQL Query Process

The SPARQL Query Process refers to the steps involved in querying data stored in a RDF (Resource Description Framework) format using SPARQL (SPARQL Protocol and RDF Query Language). SPARQL is a powerful query language specifically designed for retrieving and manipulating data in semantic web applications.

```
PREFIX ex: <http://example.org/>
SELECT ?batik
WHERE {
   ?person ex:batik ?batik
}
```

Figure 4. SPARQL Query Commands

4.4. Semantic product search view

Prospective customers of the online store can interact with one another through chatbot software available via the virtual customer care application interface. This interface enables online store customers to pose questions and receive personalized responses. It also showcases applications of chatbots that utilize ontology.

Figure 5. Semantic product search

4.5. Validation Testing

Validation Testing is a critical phase in the development of the integrated system, ensuring that both the intelligent chatbot and the semantic-based product search function as intended and meet the specified requirements. This process involves assessing the effectiveness, accuracy, and usability of the system from the user's perspective.

Table 2. Expert Validation Testing

No.	Keyword	Expected Response	Evaluate Results
1	Motif batik tulungagung	• Motif Sekar Jagad • Motif Gajah Oling • Motif Panji Kudal • Motif Gringsing • Motif Buketan • Motif Bunga • Motif Daun Simbar Menjangan • Motif Kawung • Motif Cinde • Motif Hias Tumbuh-tumbuhan/Flora • Motif Hias Manusia • Motif Binatang/Fauna • Motif Benda Alam • (Motif sapu ular) • Motif Sosial (Motif Kembang Api)	Corresponding
2	Motif Batik		Corresponding
4	Warna apa saja yang digunakan	• Merah • Jingga • Kuning-jingga • Kuning • Kuning-hijau • Hijau • Hijau-biru • Biru	Corresponding

5	Apa saja karakter batik tulungagung	• Biru-ungu • Ungu • Merah-ungu • Coklat • Abu-abu • Putih • Hitam • Batik Singosasi • Batik Celaket • Batik Druju • Motif Tertunda	Corresponding
6	Apa saja motif batik singosari	• Motif Parijoto • Motif Padma • Motif Renggo • Motif Candi Singosari • Motif Langsep • Motif Kendedes	Corresponding
7	Apa saja motif batik celaket	• Motif rambut singa • Motif tugu • Motif batik Celaket • Motif bunga bambu • Mawar pupus	Corresponding
8	Apa saja motif batik favorit	• Motif garis • Anggur • Motif kerrang • Motif bola-bola • Motif wayang • lainnya	Corresponding
9	Bagaimana proses produksi batik	• Mencanting • Menyolet • Nembok • Pewarnaan • Pencelupan • Pelorodan	Corresponding
10	Apa saja model batik malang	• Baju Wanita • Baju Pria • Baju anak - anak	Corresponding

4.6. Precision Testing

Precision Testing in the context of the research titled "Online Store Integration with Intelligent Chatbot and Semantic-Based Product Search to Improve Services" focuses on measuring the accuracy of the system in retrieving relevant and correct product results based on user queries. The goal of precision testing is to assess how well the semantic-based search engine and chatbot return relevant responses that align with user

expectations. testing with 15 different keyword iterations utilizing the developed ontology.

Table 3. Precision testing on chatbots

No	Keyword	Relevant results obtained	Total results obtained	Precision (%)
1	Baju Batik	58	58	100
2	Motif Batik	30	31	97
3	Warna Batik	17	17	100
4	Ukuran Batik	21	22	95
5	Model Batik	23	24	96
6	Motif Tulungagung	15	15	100
7	Motif Gajah Oling	18	18	100
8	Motif Sekar Jagad	12	12	100
9	Karakter Batik	20	20	100
10	Proses Produkti	24	25	96
11	Batik Modek	18	19	95
12	Jenis Batik	14	14	100
13	Ukuran Batik	23	24	96
14	Variasi Batik	22	22	100
15	Bahan Batik	12	13	92
Average				**98**

The findings presented in Table 3 indicate that within a semantic web-based search chatbot application for an online store that sells batik products, a high-quality answer is one that closely aligns with an ideal response or matches the expected answer based on the posed question. This assessment demonstrates an average precision rate of 98% and incorporates 15 distinct categories of keywords.

5. CONCLUSION

Semantic-based search is an advanced search technique that enhances the search process through context awareness. When the chatbot is unable to answer a user's inquiry, it proactively seeks additional information from the website to provide more accurate responses. This capability allows the chatbot to generate a range of questions related to the products available in online stores. In testing, the system demonstrated an impressive average accuracy rate of 98% across 15 different keywords, successfully delivering correct answers for 10 distinct queries. Chatbots that utilize ontologies as part of their virtual customer service are designed to interact effectively with potential customers in online retail environments. By leveraging this intelligent search approach, businesses can improve their customer service interactions, ensuring that users receive timely and relevant information. This not only enhances user satisfaction but also strengthens the overall effectiveness of the online shopping experience. Through the integration of

semantic-based search and chatbot technology, online stores can significantly elevate the quality of service they provide, ultimately leading to improved customer engagement and retention. The use of context-driven responses is crucial for addressing customer needs in a dynamic online marketplace.

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