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Implementation of a Multi-Platform Hybrid Chatbot for Digital Customer Service (Case Study: Batik Wistara, Surabaya)

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Abstract. The rapid development of artificial intelligence and digital transformation in e-commerce has encouraged micro, small, and medium enterprises (MSMEs) to provide faster, more responsive, and continuously available customer services. In traditional batik businesses, real-time interaction is increasingly important because customers require detailed information regarding motifs, color variants, prices, stock availability, and purchasing procedures. However, customer services that rely solely on human operators are constrained by limited operating hours, service capacity, and information consistency, which may lead to delayed responses and reduced customer satisfaction. This study develops a hybrid chatbot for Batik Wistara by combining rule-based mechanisms, Natural Language Processing with synonym-based token expansion, and Groq AI as a Large Language Model-based conversational reasoning engine. The chatbot is deployed as a multi-channel customer support system through the Batik Wistara website, WhatsApp Bot API, and Telegram Bot API using a bidirectional webhook architecture. Integration with the Batik Wistara e-commerce database enables the chatbot to deliver accurate, consistent, and real-time product and transaction information. The implemented system is expected to improve service efficiency, enhance customer experience, ensure consistent information delivery across platforms, and reduce the operational workload of business owners.

Keywords: Hybrid Chatbot, Natural Language Processing, Groq AI, Batik MSMEs, Messaging Bot API

1. INTRODUCTION

Micro, Small, and Medium-Sized Enterprises (MSMEs) in Indonesia are among the business actors operating in the e-commerce sector that have been greatly impacted by the development of artificial intelligence (AI) technology and digital transformation over the past ten years. Consumer behavior has changed as a result of the digital ecosystem's explosive growth, with consumers placing a higher value on online communication's effectiveness, speed, and ease of access. Due to this circumstance, business actors—particularly MSMEs—are compelled to develop customer service systems that can function consistently around-the-clock without being constrained by time or place. In addition to offering digital tools, this shift focuses on how technology may enhance the effectiveness and caliber of consumer-business actor interactions on digital platforms [1], [2].

Customer service that is both knowledgeable and responsive is becoming more and more important in the context of traditional batik MSMEs. Customers want product information including color variants, a variety of batik motifs, reasonable pricing, real-time stock availability, and explanations of sometimes complicated purchase procedures. The capacity, working hours, and consistency of information offered by service systems that still depend on human operators are all limited. Response delays, inconsistent information, and even a decline in customer pleasure could result from these restrictions, which could eventually lower MSME loyalty and transaction volume [1], [3].

The use of chatbots to automate customer care has been a popular solution to these problems. While lessening the workload of human operators, chatbots have demonstrated the ability to provide reliable and effective real-time conversations. However, the deployment of chatbots in Indonesia, particularly in the MSME sector, has been rather straightforward thus far and often employs a single strategy, such as rule-based or retrieval, each of which has pros and cons. Rule-based chatbots are perfect for structured menu navigation since they have a consistent and planned discourse structure. They are less capable of managing a variety of user languages and more natural conversational settings. On the other hand, chatbots with Natural Language Processing (NLP) skills allow for a more flexible interpretation of user intent. However,

response stability is limited and, in the absence of sufficient conversational control systems, can occasionally be unpredictable [1], [4].

A more efficient and flexible method is thought to be a hybrid chatbot strategy that incorporates rule-based mechanisms, natural language processing (NLP) with synonym token expansion, and the incorporation of contemporary Large Language Model (LLM) technologies. In the context of traditional batik MSMEs, which necessitate a thorough grasp of local products and culture, this hybrid model is able to maximize answers in meeting complex and varied customer contact needs by utilizing the advantages of each method [3], [9].

Although the use of the appropriate platform is crucial to modern digital strategies, there hasn't been much research or deployment of hybrid chatbots that support extensive multi-channel communication in MSMEs in the past. Due to WhatsApp's widespread use, accessibility, and flexibility in the setting of small and medium-sized organizations, using it as the primary communication channel has become popular in Indonesia. The WhatsApp Business API's chatbot integration enables effective two-way automated message management, real-time response delivery, and data reception via webhooks, which facilitates the system's ability to promptly anticipate user inquiries. Implementing chatbots on both platforms at the same time offers flexibility and increases the reach of customer contacts because Telegram, in addition to WhatsApp, has demonstrated strong growth as an alternative platform for business automation and digital communities [3], [17].

In this study, a multi-channel chatbot system was created and put into use using the Batik Wistara MSME website platform, which is directly connected to an e-commerce database, the WhatsApp Business API, and the Telegram Bot API. Customers may easily select communication media depending on their preferences thanks to this method, which also enables the service system to modify responses based on the most recent information from the product catalog, stock, order status, and news updates. In this sense, the chatbot enhances an engaging and customized buying experience in addition to serving as a quick response tool [8], [26].

Groq AI's function as an LLM-based conversational agent is integrated into the suggested hybrid chatbot architecture. Its job is to provide reasoning and free-flowing discussion with characteristics similar to human interaction. Contextual responses, comprehensive explanations, and customized product suggestions based on customer requirements and preferences are all supported by Groq AI. An NLP module with a synonym-based token expansion mechanism that conducts product searches using keywords and local phrases, as well as a rule-based module that manages menu navigation and rule-based dialogue flows, enable Groq AI's function. For ongoing assessment and improvement of chatbot services, an interaction log system is also added.

Data on the increasing trend of e-commerce transactions in Indonesia, which continues to see notable rises, supports the significance of this hybrid chatbot function. Important e-commerce transaction statistics from year to year is shown in Table 1. The early years' rise in transactions, especially during the COVID-19 pandemic, signaled the acceleration of consumer digitization, which became a critical momentum in Indonesia's shift in online buying behavior.

Table 1. Growth of e-commerce transactions in Indonesia (2019–2023)

Year	Transaction Amount Number (Trillion Rupiah)	Growth (%)
2019	205,5	-
2020	266,3	29,6
2021	401,0	50,5
2022	476,3	18,8
2023	501,2	5,2

According to Table 1, total transactions reached 205.5 trillion rupiah in 2019 and rose dramatically to 266.3 trillion rupiah in 2020, a 29.6 percent increase driven by rapid digitization brought on by the COVID-19 pandemic. The transaction value peaked in 2021 with 401 trillion rupiah, a 50.5 percent increase from the year before. Despite a slowdown in growth over the next two years, transaction value increased steadily and reached 501.2 trillion rupiah in 2023.

MSMEs must innovate in terms of customer service quality by offering quick, accurate, and responsive communication due to the dynamic market conditions. MSMEs who have

not implemented service automation technologies run the danger of encountering response delays, which may diminish their ability to complete transactions and compete in the online market. In order to help Batik Wistara MSMEs adapt to the increasingly complex and dynamic issues of customer service in the digital age, this study highlights the significance of developing a hybrid chatbot based on rules-based, NLP, and LLM as a strategic solution.

2. METHODS

The research approach utilized at Batik Wistara MSME to create a hybrid chatbot system is covered in this chapter. The technology and technical implementation that enable chatbot integration with different communication platforms, system architecture design, and Waterfall-based research stages are all covered.

2.1. Community Service Development Process

The Waterfall software development paradigm is the methodological framework used in this study. The Waterfall model was selected because it is methodical and sequential, allowing for the systematic and thorough execution of every step of the process, including requirements analysis, design, implementation, testing, and maintenance [2], [29].

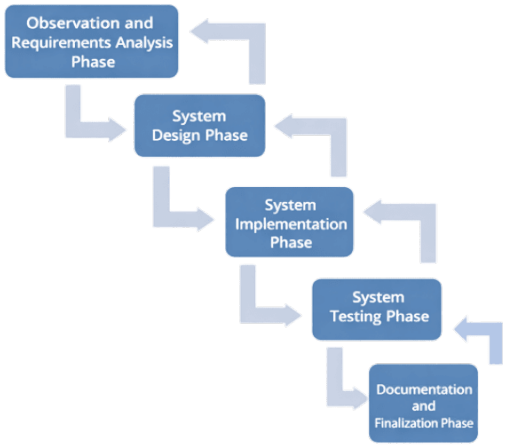

Figure 1. Chatbot development waterfall diagram

According to Figure 1, the development team directly involved stakeholders, including MSME owners and the operational team, in order to gather and analyze system needs in the first stage. In order to comprehend the functional and non-functional needs that

must be fulfilled, such as the chatbot system's capacity to offer 24-hour service, information consistency, and quick response to client requests, key activities included interviews, talks, and observations. A software requirements specification (SRS) document that formed the foundation for the entire ensuing development process was the outcome of their efforts [5], [11].

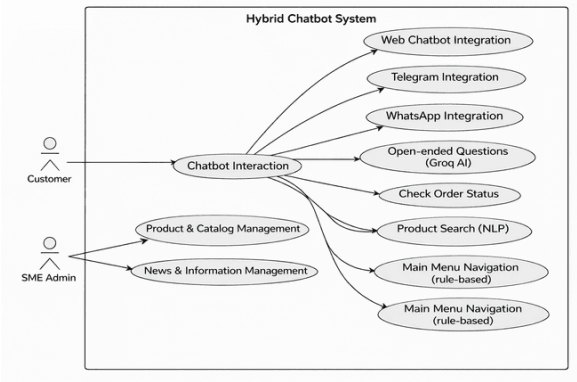

Figure 2. Use case diagram of a hybrid chatbot system

According to Figure 2, the customer actor uses the chatbot interaction feature to browse rule-based menus, check order status, search for items, and freely request information using Groq AI. In the meantime, the MSME Admin actor is able to control news and information that is shown on the website and chatbot, as well as products and catalogs. The interaction between the website and chatbot as an integrated system that facilitates digital information management and customer care procedures is depicted in this diagram.

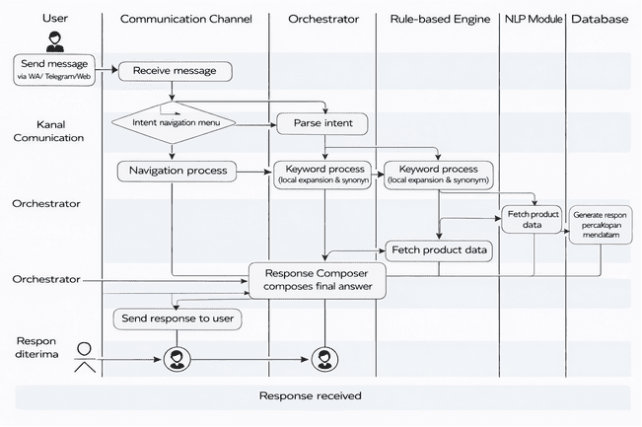

Figure 3. Activity diagram of a hybrid chatbot system

From the standpoint of functional workflow, the activity diagram in Figure 3 provides a more thorough explanation of system actions. From the user sending a message to the orchestrator processing the intent, choosing a processing module according to the type

of request, and the system producing the final response are all shown in this diagram. Depending on the kind of message, the activity flow is divided into several channels, demonstrating the parallelism of execution—a major benefit of the hybrid approach. The activity steps that support the efficacy of automated digital services are shown in this diagram.

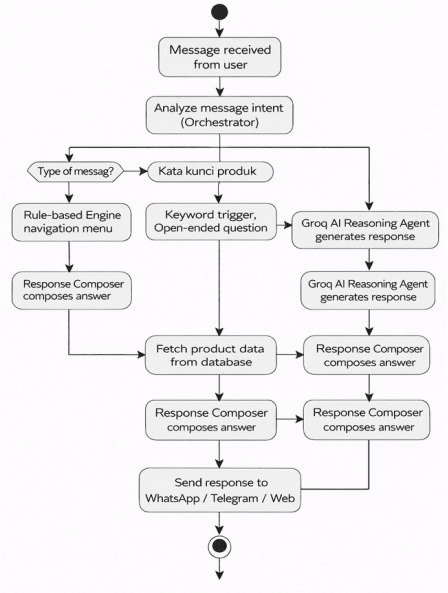

Figure 4. Logic flowchart

The logical flow of message processing from the user till the chatbot's response is returned to the communication channel is depicted in the flowchart in Figure 4. After the system receives the message, the orchestrator determines the message processing path by identifying the message's intent. The message is sent to the rule-based engine if it fits the menu pattern.

The NLP module processes it for token expansion and synonym mapping if it contains product search terms. The Groq AI model is used as a reasoning agent when a communication contains an open-ended query. The Response Composer chooses and formats the response to be provided to the user after each module has produced an answer.

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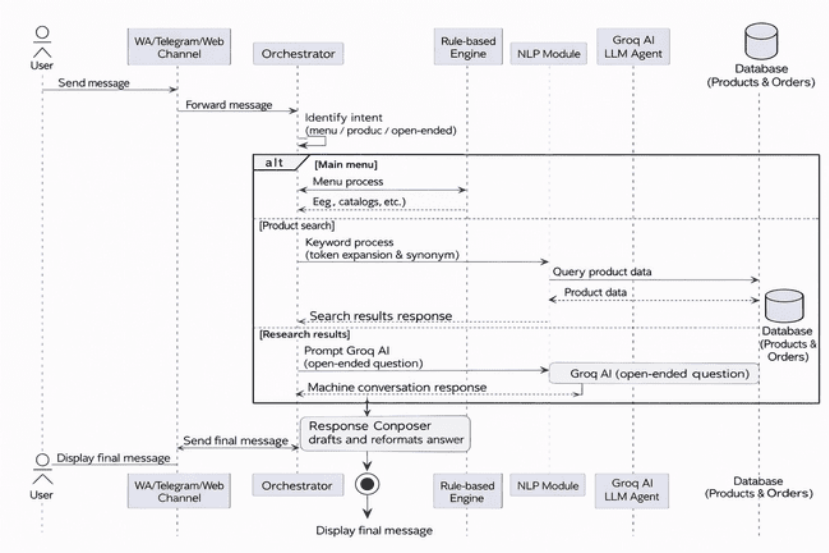

Figure 5. Sequence diagrams

The sequence diagram in Figure 5 depicts how the internal components of the system interact chronologically when processing a single conversation cycle. When a user sends a message via WhatsApp, Telegram, or the web, the sequence starts. The message is then sent to the orchestrator for intent identification. The orchestrator uses Groq AI, an NLP module, or a rule-based engine based on the analysis. To obtain product information or order status, the NLP module can communicate with the database. Once everything is finished, the orchestrator uses the Response Composer to assemble a response, which it then sends back to the communication channel so the user can see it. The sequence diagram describes the technical specifics of the parts needed to operate a chatbot service consistently and in real time.

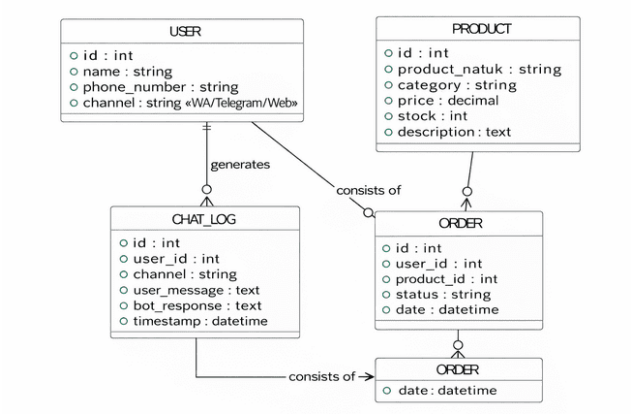

Figure 6. Entity Relationship Diagram (ERD)

An ERD used to specify the database structure that forms the basis for information storage in a hybrid chatbot system is depicted in Figure 6. The User, Product, Order, and Chat Log are the four primary entities. Data about users engaging with the system is stored in the User object. Order keeps track of customer transaction data, Product keeps track of MSME catalog information, and Chat Log keeps track of user-chatbot conversations as a record of communication and analysis for system enhancements. The interdependence of system operations, where a single user can carry out numerous transactions and start numerous conversations, is reflected in the relationships between entities. When processing messages and making product suggestions, this structure guarantees data consistency and integrity.

System design is the second phase. The next step is to build the hybrid chatbot system architecture after the requirements have been thoroughly examined and documented. High-level designs like the overall system architecture, mapping the rule-based chatbot modules, NLP, and Groq AI, as well as interaction with WhatsApp, Telegram, and website communication platforms, are all part of this stage. Low-level designs are also made, such as database design, algorithms, use case diagrams, activities, flowcharts, and sequences to precisely map the system's internal components and user interaction flow. The design phase's objective is to provide a clear blueprint that will serve as an implementation guide so that the system constructed may satisfy the requirements.

The creation and execution of system modules constitute the third phase. At this point, developers start utilizing the Laravel 12 framework to translate the design into program code. Developing a backend API module that can receive and handle client requests from different communication channels is part of the development process. Real-time two-way conversation is made possible via the webhook method that connects the chatbot module to the Telegram Bot API and WhatsApp Business API [14]. To offer flexible service access, the chatbot's online version is also linked into the Batik Wistara MSME application over an internal API. Effective implementation guarantees that the system can operate in accordance with design standards.

The testing procedure is the fourth step. Functional testing was carried out using black-box techniques once the system was constructed to make sure all features operated in accordance with specifications. Product and order database administration, open-ended

question processing using Groq AI, WhatsApp and Telegram API integration, menu navigation, and product search using synonym token expansion were all tested. Ten responders who represented MSME clients participated in user acceptance testing in addition to technical testing to evaluate response speed, usability, accuracy of responses, and happiness with chatbot interactions. Before going on to the next phase, the testing's results were crucial in helping to develop and polish the system.

The maintenance phase is the fifth stage. After the system is put into service, maintenance is done by keeping an eye on user interaction logs that document all of the chatbot's interactions and chats. To find bugs, operational problems, and the need for more feature development, this data is evaluated. In order to keep the system compatible with the newest chatbot technology and communication platforms, maintenance also entails frequent updates.

The documentation and finalization step then includes a methodical documentation of all monitoring outcomes, improvement analysis, and system modifications. Feature updates, improved discussion flow, and instructions for system usage and upkeep are all included in this manual. The goal of the documentation and finalization step is to guarantee that the chatbot system is ready for ongoing usage, simple to maintain, and capable of future development in accordance with MSMEs' business requirements.

2.2. Architectural Models

Users, a webhook API gateway, a Chatbot Hybrid Engine with rule-based, NLP, and Groq AI, the Batik Wistara e-commerce database, and external platform API modules for Telegram and WhatsApp make up the hybrid chatbot system architecture. The following is a description of the system's communication process:

1) Users use an online chatbot, Telegram, WhatsApp, or another communication channel to exchange messages. Commands for menu navigation, product search terms, transaction-related questions, and open-ended questions that need a thorough explanation are examples of received messages. These messages are recorded via the channel interface using an internal web widget, the Telegram Bot API, or the WhatsApp Business API.
2) After that, the message is sent to the Webhook API Gateway for normalization and processing. The webhook receives message events in real time and serves as

the main server-side gateway. In order for the Chatbot Hybrid Engine to read messages consistently, this procedure entails parsing the message format, verifying the structure, and standardizing the input format across platforms. The chatbot orchestrator, which serves as the conversation flow's central control center, receives the ensuing payload [3].

3) The Chatbot Hybrid Engine employs three techniques for intent analysis in order to choose the best processing path:
    a. A rule-based engine for communications that match structured menu patterns, including news, product catalogs, stock checks, pricing details, admin contacts, and addresses.
    b. An NLP module that uses token expansion, stemming, and synonym mapping to handle messages containing product search keywords for flexible search, independent of spelling changes [16].
    c. A Groq AI model built on the LLM (Learning Language) that generates conversational, natural answers to open-ended, argumentative, or reasoning queries.
4) To obtain the actual data required for the response, including stock status, product catalog, order details, and the most recent news, the engine makes use of the MSME's database and e-commerce system. Real-time and consistent data provided by customers is guaranteed by internal API integration.
5) The Chatbot Hybrid Engine uses the Webhook API to deliver the response back to the user's original platform after the response composer has structured it. This ensures that the user receives an informative text reply quickly.

Table 2 lists the primary features of the hybrid chatbot integration platform, the API technologies that are employed, and their corresponding functions within the system as a whole. The main channels for real-time text exchanges with clients are the Telegram Bot API and WhatsApp Business API, which use HTTP Bot API asynchronously and JSON webhook technologies. With the use of Laravel's internal API, Web Chatbot offers customers an alternate web-based communication channel that eliminates the requirement for an external chat program.

Table 2. Chatbot Integration Platform Details

Platforms	Main Function	API Technology	Role in the System
WhatsApp Business API	Real-time chatbot service	Webhook JSON	Main conversation channel
Telegram Bot API	Communication alternatives	HTTP API Bots	User-free conversation
Chatbot Websites	Multiplatform support	Laravel Internal API	Web-based service channel
Groq AI	Conversational reasoning	LLM-based agent	Intelligent free dialogue
Laravel API	Chatbot backend server	REST API	E-commerce data integration

Groq AI functions as an LLM-based reasoning agent, offering comprehensive answers, particularly to open-ended queries that rule-based or natural language processing are unable to address. The backend server is managed by the Laravel API, which offers REST API endpoints for data exchange with e-commerce databases, including MSME news, products, stock, and transaction status. This partnership guarantees that the hybrid chatbot system can deliver current information, natural dialogues, and a quick and reliable user experience across several communication channels.

2.3. Technology And Technical Implementation of Architectural Models

A structured dialog flow method based on conditional branching logic was used to create the rule-based module. The system is able to give consistent and regulated responses because each primary menu item is organized using a response script that is kept in a static data structure on the backend server. Deterministic navigation demands, like opening the product catalog, displaying price and stock information, MSME news, store addresses, and admin contacts, are the main emphasis of this rule-based logic. The chatbot can more easily guide customers through an understandable menu hierarchy flow thanks to this method [18].

Various messages that need meaning recognition are processed using the Natural Language Processing (NLP) module. Tokenization, which divides sentences into individual

words, and text cleaning, which uses techniques like lowercasing, punctuation removal, non-standard word normalization, and stopword removal to cut down on noise, are both part of the NLP process. Subsequently, synonym mapping is used to overcome many variants of terms with similar meanings, such as "sogan," "old chocolate," "classic brown," or "luxury" and "premium." To ascertain whether the message relates to product searches, information requests, or order processing, intent detection is accomplished by straightforward categorization utilizing pattern matching and synset priority weights [19].

The Large Language Model (LLM)-based Groq AI module is responsible for managing free-form dialogues that call for intricate justifications and in-depth explanations. The chatbot can produce contextual, natural, and human responses using the Groq AI agent API.

Applications include suggestions for batik motifs for formal events, graduations, parties, or informal occasions; recommendations for color combinations based on personal preferences; educational explanations pertaining to the philosophy of traditional batik motifs; consultative or argumentative responses not addressed by other modules; and stock availability estimation by combining the context of prior conversations. With this reasoning module, the chatbot becomes an interactive digital assistant rather than merely a question-and-answer machine [17], [20].

The Telegram Bot API and WhatsApp Business API, which are built on HTTP/JSON webhooks and allow real-time message sending and receiving without polling, are the main communication channels. This guarantees that even when numerous users visit the chatbot at once, it can react promptly and concurrently [1], [30].

In order to provide REST API endpoints, data processing logic, and connectivity between the Chatbot Hybrid Engine and the database, the backend is constructed using Laravel 12 as an API server. Orders, user discussion logs, and product catalog information are stored in a MySQL database to provide structured data management. Middleware authentication, API route management, and integration scalability with Batik Wistara MSMEs' current e-commerce system are made easier by the usage of Laravel.

All message traffic activity is tracked by a logging system that documents incoming and outgoing messages, response times, error detection, and message delivery success rates

in order to ensure dependable cross-platform communication. In order to enable debugging procedures, ensure service consistency, and assess chatbot performance under complicated and dynamic operating situations, these methods are essential.

3. RESULTS AND DISCUSSION

The outcomes and discussion of the hybrid chatbot system's implementation, which was created in the earlier phase, are presented in this chapter. The performance of the system in managing different kinds of user interactions using NLP, AI models, and a rule-based approach is the main topic of discussion. Additionally, testing outcomes and chatbot response observations are utilized to assess how well the system supports information services on the Batik Wistara platform.

3.1. Hybrid Chatbot System Implementation

The successful integration of the Laravel 12 backend, which offers APIs for product catalog data, news, order status, and conversation history, is demonstrated by the deployment of a hybrid chatbot system on three popular communication platforms: the WhatsApp Business API, the Telegram Bot API, and a web chatbot. Groq AI functions as a reasoning agent to handle free-flowing conversations needing in-depth explanations, while the rule-based module controls structured menu navigation and the NLP module controls product search utilizing token expansion and synonym mapping techniques. The implementation of the chatbot on the Batik Wistara platform is shown through a series of displays in Figures 7 to 9.

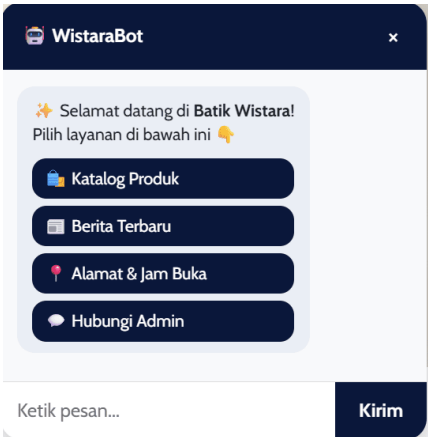

Figure 7. Chatbot display on the Batik Wistara website

Figure 7 shows the initial chatbot interface on the Batik Wistara website, where users are immediately presented with four main service options, namely Product Catalog, Latest News, Address & Opening Hours, and Contact Admin. The presentation of the menu in the form of interactive buttons, as shown in Figure 7, shows a user-experience-oriented design approach, making it easier for users to select services without having to type manual commands.

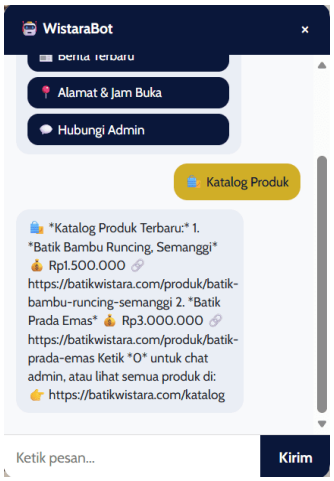

Figure 8. Chatbot display when selecting the "Product Catalog" menu

The chatbot's reaction when a user chooses the Product Catalog menu is then displayed in Figure 8. The chatbot automatically provides a list of the newest products in this view, along with links to product pages, pricing, and descriptions. The system's direct connection to the e-commerce database is demonstrated by this data-driven automated response, guaranteeing that the content offered is constantly current and consistent across channels.

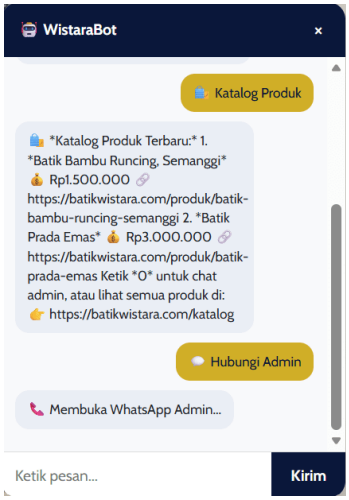

Figure 9. Chatbot display when selecting the "Contact Admin" menu

The display that appears when a user chooses the Contact Admin menu is then seen in Figure 9. The chatbot offers a button in this section that takes users to the admin's WhatsApp. Chatbot integration on instant messaging platforms is also demonstrated in Figure 10 for WhatsApp and Figure 11 for Telegram. On both platforms, the display format remains consistent with the web version, demonstrating that the hybrid system successfully handles multi-channel integration centrally.

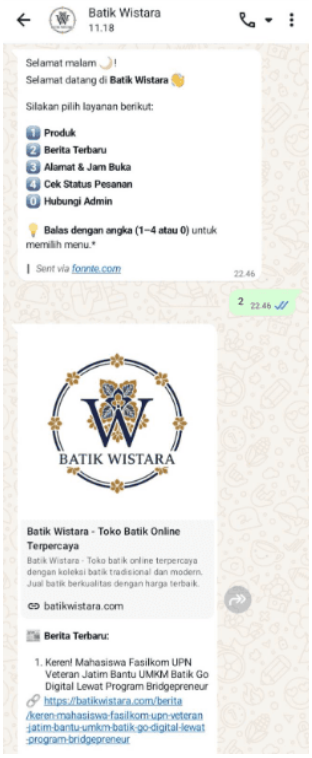

Figure 10. Chatbot display on WhatsApp

The order status check function, seen in Figure 11, enables users to check independently without depending on the administrator. Users can access the same menu as on the website and obtain real-time results.

Figure 11. Chatbot display on Telegram

Through ease of use, information consistency, and real-time response, the built chatbot not only serves as automated information but also enhances operational effectiveness and customer service quality, as demonstrated by an analysis of the entire visual presentation [8], [22].

3.2. Functional Testing Results (Blackbox Testing)

Ten functional scenarios based on the main characteristics of the chatbot system were subjected to blackbox testing, as indicated in Table 3. The following table displays the test results:

Table 3. Hybrid Chatbot Blackbox Test Results

No	Testing Scenarios	Status	Results	Information
1	Access the chatbot main menu	Success	Valid	The menu appears according to the format
2	Product catalog response	Success	Valid	Data appears in real-time
3	NLP-based product search	Success	Valid	Nonstandard word detected
4	WhatsApp API integration	Success	Valid	Messages received and replied automatically
5	Telegram Bot API integration	Success	Valid	Uniform dialogue structure
6	Groq AI free conversation	Success	Valid	Natural response
7	Check order status	Success	Valid	Data according to database
8	Fallback handling	Success	Valid	Switched to Groq AI
9	Multi-platform response	Success	Valid	Synchronous and stable
10	Response time	Success	1.2 s	Average response

The outcomes of functional testing, also known as user acceptance testing, that was carried out to verify every feature created in the hybrid chatbot system are displayed in Table 3. Without looking at the actual code structure, testing was done by looking at input and output. Every scenario displayed a "Success" status and a "Valid" result, signifying that the feature operated in compliance with the system's criteria. The system presented the entire menu structure in the intended format in the chatbot's primary menu access scenario. Real-time product information and stock availability that were obtained straight from the e-commerce database were successfully presented during

product catalog response testing. The chatbot was able to identify changes in keyword spelling, including non-standard phrases or synonyms, during the NLP-based product search stage, improving the search process' accuracy and flexibility. Both scenarios successfully displayed steady responses with consistent dialogue patterns when the communication channel integration was evaluated using the Telegram Bot API and the WhatsApp API.

The chatbot was able to respond to open-ended queries in a natural and comprehensive manner in the free-flowing discussion scenario using Groq AI, enhancing the agent's ability to reason in human-like conversations. It has been demonstrated that the order status check feature provides real-time information based on database data. In order to avoid discussion dead ends, the system redirected unidentified messages to the Groq AI agent in the backup handling scenario, which likewise showed valid results. Even when reached via several platforms, synchronous and reliable answers were shown by multi-platform response testing. Performance-wise, reaction time measurements produced an average response time of 1.2 seconds, which satisfies user comfort levels and is still within the responsiveness range of contemporary chatbots [7]. These findings show that real-time interactions are supported and the message processing, routing, and API integration systems are operating at peak efficiency.

3.3. User Experience Test

Ten respondents were tested quantitatively using a Likert scale (1–5), as shown in Table 4. Response speed, usability, accuracy of responses, information fullness, and overall satisfaction were the five primary metrics used. To determine the system's efficacy, the data underwent descriptive testing and score trend analysis. The findings of the hybrid chatbot system's user experience evaluation, which used a Likert scale of 1 to 5, are shown in Table 4. Ten respondents who have used the chatbot via Telegram, WhatsApp, or the internet completed the assessment. Response speed, convenience of use, accuracy of chatbot responses, completeness of information, and overall satisfaction were the five primary metrics included in the assessment tool. Every indicator shows how users feel about the system's comfort and interaction quality. With an average score of 4.7, the response speed indication showed that the chatbot met user expectations and the requirement for responsive digital communication by responding promptly and in real time. The conversational interface is simple to comprehend and menu navigation is

obvious without the need for extra assistance, according to the ease of use indicator, which also obtained a high score of 4.6. The chatbot's response accuracy indicator scored 4.5, indicating that it uses both rule-based and natural language processing to offer pertinent answers to user inquiries [6].

Table 4. User Experience Assessment Instrument (Likert Scale 1–5)

Indicator	Information	Average Score
Response speed	Average response time of the system	4.7
User convenience	User perception of the interface	4.6
Accuracy of chatbot answers	Appropriateness of answers to questions	4.5
Completeness of information	Including products, prices, stock, links	4.6
Overall satisfaction	Global assessment of chatbot systems	4.7

Despite being the lowest of the other indications, this score is still in the very good range and shows potential for improvement, especially in comprehending the context of more difficult questions. Users thought the information offered by the chatbot through the product catalog, prices, stock, and supporting links was adequate to satisfy their transaction demands, as shown by the information completeness indicator's score of 4.6. The system's overall performance was positively accepted by users, as evidenced by the overall satisfaction indicator's highest score of 4.7 [23].

3.4. Test Graph

The findings of the hybrid chatbot system's user experience evaluation, which was based on five primary indications with a Likert scale of 1 to 5, are displayed in Figure 12. The results of the hybrid chatbot system's user experience evaluation based on five key indications on a 1–5 Likert scale are displayed in Figure 12. The system was able to provide answers promptly and had a generally excellent user experience, as evidenced by the response speed and overall satisfaction indicators receiving the highest score of 4.7.

Users found the conversational interface to be straightforward to comprehend, and the information offered by the system was deemed comprehensive and pertinent, according

to the ease of use and completeness of information indicators, which obtained a score of 4.6. In the meantime, the chatbot's accuracy score was 4.5, which is the lowest but still falls into the very good category and shows potential for improvement in terms of more sophisticated context processing. Overall, the test results demonstrate that the hybrid chatbot system has performed well and offered a satisfying user experience [27].

Figure 12. Test Results Graph

3.5. Discussion

According to test results, a hybrid strategy that combines Groq AI as a reasoning agent with rule-based, token expansion-based NLP modules performs very well when managing real-time client interactions across several platform channels. High response consistency was shown in multi-channel testing on Telegram, WhatsApp, and a web chatbot since all of the information the chatbot displayed was obtained straight from the Batik Wistara e-commerce system via the API. As a result, even when customers used different platforms, there were no differences in information about product catalogs, prices, and order statuses. For MSMEs, who depend on the speed and quality of information in the transaction process, this consistency is an essential component of digital services [15], [28].

The quality of open discussions is greatly enhanced by the incorporation of Groq AI. Groq AI can produce more natural, persuasive, and contextual responses than rule-based systems, which can only produce restricted responses based on preset menu structures. Recommendations for choosing batik motifs for official or informal occasions, matching clothing colors to particular themes, adjusting fabric selections according on the user's age, and offering philosophical justifications for particular batik motifs are just a few of

the consultative queries that the system can respond to. If the system relied only on rule-based systems or NLP pattern matching, this reasoning power would not be conceivable because neither method is capable of deep semantic understanding [12], [13].

Because the system may automatically reroute processing channels according to the type of message received, this hybrid approach has also been shown to improve user experience. The NLP module uses token expansion and synonym mapping to conduct the search when a user inputs a product phrase, removing misspellings. On the other hand, the orchestrator sends the message to Groq AI if the inquiry is vague and unstructured. Compared to standard chatbot models, which frequently run into dead ends or misunderstandings, this adaptive design produces a more adaptable and responsive interaction experience [10], [21].

Overall, the findings of the system testing show that using a hybrid model enhances the efficiency, precision, and caliber of discussions in automated customer support for MSMEs. This reinforces the conclusion that the best way to meet the demands of round-the-clock digital customer service with quick reaction times, consistent information, and sophisticated conversational capabilities is to integrate rule-based, NLP, and Groq AI [24], [25].

4. CONCLUSION

This study successfully developed a hybrid chatbot system that integrates rule-based mechanisms, NLP-based token expansion, and Groq AI as a conversational reasoning engine across three communication channels: the WhatsApp Business API, Telegram Bot API, and a web-based chatbot. The system enables Batik Wistara to provide faster, more consistent, flexible, and continuously accessible digital customer service. By combining structured navigation with adaptive conversational capabilities, the proposed approach overcomes the limitations of a single chatbot model, improves query interpretation, and generates more natural responses while maintaining reliable access to essential information, including product catalogs, stock availability, news updates, and order status. The testing results demonstrated satisfactory performance, with success rates ranging from 92% to 96% and an average response time of approximately 1.2 seconds. User experience evaluation also indicated that the chatbot was easy to use and achieved a

high level of user satisfaction. Groq AI contributed significantly to handling complex and open-ended questions, whereas the rule-based and NLP modules ensured stable and structured service delivery. The multi-channel deployment increases system accessibility and allows users to select their preferred communication platform. Overall, the findings demonstrate that a hybrid AI chatbot is an effective solution for improving digital customer service, accelerating purchasing decisions, reducing operational workload, and strengthening the competitiveness of traditional batik MSMEs. Future development may include sentiment analysis, machine learning-based product recommendations, and a real-time omnichannel dashboard to support data-driven marketing and operational decision-making.

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