Implementation of Chatbot to Improve Service in Purchasing Batik

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Abstract— The rise of e-commerce has significantly changed consumer purchasing behavior. For example, the purchase of culture-related goods such as batik is now also done online. Currently, batik sellers often rely on manual communication, such as short messages, to provide product and business information, which causes delays in response time and potential lost sales opportunities. In addition, batik sellers also often receive the same questions from customers, making it ineffective and inefficient in running their business. To overcome this problem, a chatbot named BatikBot was created in the form of a website. This chatbot aims to answer common questions that customers often ask to increase customer satisfaction and operational efficiency. The method used in the development of this chatbot is the waterfall method, which is modeled with a use case diagram, activity diagram, and sequence diagram. The development process uses Program O as a tool for making chatbots. The final result of this development is a website with a chatbot named BatikBot that is expected to not only improve the shopping experience for consumers but also support batik sellers in managing their business more effectively while contributing to the preservation of Indonesia's cultural heritage.

Keywords— chatbot, batik, culture, waterfall method, Program O

I. INTRODUCTION

Today's modern life cannot be separated from the rapid advancement of information technology, which makes many changes in life. One of them is changes in consumer purchasing behavior, which now often shop online. These changes make many business sectors have to adapt and sell their products online. Although buying and selling transactions are carried out online and do not meet face-to-face directly with consumers, the thing that should not be missed is customer service [1].

This encourages various business sectors to utilize and adopt technology in order to improve their business, customer service, and operational efficiency. One of the innovations of technology that can be used is a chatbot. A chatbot can be defined as a computer program designed to simulate human conversation [2], [3]. Chatbots have the potential to deliver a range of benefits that drive increased customer satisfaction. Chatbots provide quick and consistent responses to customer questions, requests, or concerns. The ability of chatbots to respond in a short time makes them an efficient tool for providing instant assistance to customers [4]. So chatbots can be used to improve service to customers. This quick response can significantly increase customer satisfaction by providing an efficient and responsive experience [5]. Although it is made to have conversations with humans, there is actually no human intervention in the conversation, but the machine does the work, minimizing time and cost [6].

Batik is a piece of cloth that is traditionally made and has a variety of specific ornamental patterns [7]. Batik is an art that comes from ancestors and is passed down from generation to generation to be

preserved and cultivated so that the use of batik is timeless [8]. In addition, UNESCO has designated batik as one of 76 intangible cultural heritages, making batik even more desirable. The batik trend in most people has become a source of income for the batik entrepreneur community so it is not surprising that new batik entrepreneurs have sprung up in several regions in Indonesia [7].

Currently, batik sellers often rely on manual communication, such as short messages, to provide information about their products and business. This causes delays in response time, and potential lost sales opportunities. In addition, batik sellers also often receive the same questions from customers, making it ineffective and inefficient in running their business. To overcome this problem, a chatbot named BatikBot was created in the form of a website. This chatbot aims to answer common questions that customers often ask. So, it is expected to improve the shopping experience for consumers and support batik sellers in managing their business more effectively while contributing to the preservation of Indonesia's cultural heritage.

Here are some related previous studies. The Use of Chatbots in Improving Customer Experience on E-commerce Sites, 2024, written by Sari Noorlima Yanti, discusses the application of chatbot in improving customer service on e-commerce sites. This research shows that chatbots contribute to increased service responsiveness, personalization of the customer experience, and efficiency of the purchasing process. Chatbots also play a role in handling customer complaints and analyzing user behavior data. This research recommends increasing artificial intelligence, integrating emotional intelligence, and periodic evaluation and training to increase the effectiveness of chatbots in increasing e- commerce competitiveness [9].

The Role of AI Technology in Customer Service Chatbot Development, 2024, written by Kholisatunnisa and Dwi Novaria Misidawati, discusses the utilization of artificial intelligence (AI) in chatbots to improve customer service. This research uses the literature review method and analyzes the benefits, challenges, and impact on operational efficiency and customer satisfaction. The results showed that AI-based chatbots can improve service efficiency and reduce operational costs, although there are still challenges in natural language processing and data security. Recommendations from this study include improving NLP, integrating machine learning, and implementing stricter security measures to improve chatbot performance in the business world [10].

Public Service Chatbot Development Using Machine Learning and Natural Language Processing, 2023, written by Muhamad Mustaqim, Ari Gunawan, Yudistira Bagus Pratama, and Iski Zaliman, discusses the utilization of artificial intelligence-based chatbots to improve the quality of public services. This research uses a case study method and applies machine learning and Natural Language Processing (NLP) to the chatbot. The results show that chatbots can provide faster, more accurate and efficient services in answering public questions and help save operational costs. Despite challenges in natural language understanding and data processing, the integration of AI technology still provides significant benefits in improving the effectiveness of public services [11].

Development of Chatbot-Based Batik Klampar, Pamekasan Selection Recommendation Information System Using Chatbase Website, 2023, written by Prita Dellia et al., discusses the development of a chatbot system to help customers choose Klampar batik in Pamekasan. This system is designed to overcome difficulties in determining batik motifs, quality, and prices. This research uses the Chatbase Website platform to develop a web-based chatbot that provides

recommendations based on customer preferences. The results show that the chatbot increases customer confidence in choosing batik while providing insight to producers about market preferences. This system is expected to help preserve and develop the local batik industry in Pamekasan [12].

II. METHOD

The method used in the development of the BatikBot chatbot is the Waterfall method. The Waterfall method is a method with a systematic approach and is also sequential (step by step) in software development [13].
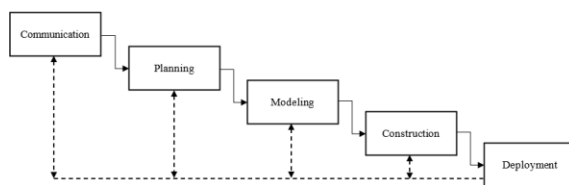
Fig. 1. BatikBot Chatbot Development Waterfall Method [14]**.**

Figure 1 shows the steps of BatikBot chatbot development using the waterfall method. There are several stages, starting with communication, planning, modeling, construction, and deployment.

A. Communication
The communication stage is the stage for analyzing the needs needed to create a system [15] and the initial stages of making a chatbot before proceeding to the technical stages. At this stage, communication with batik sellers is needed to analyze the initial needs so that the BatikBot chatbot can be in accordance with what is wanted and needed. This starts with analyzing the problems that often occur, collecting the necessary data, and explaining the functions and features of the chatbot.

B. Planning
The next stage is planning, which will explain the estimated work and techniques

that will be carried out, the risks that may occur, the estimated time required in manufacturing, tracking the work process, the resources needed, and the desired work results [16] in the development of the BatikBot chatbot.

C. Modeling
The next stage is modeling, which will describe the model of the system to be designed [17]. This stage focuses on the appearance of the interface on the website, the design of the data structure, and the program algorithm where the tools used are Program O. The purpose of this stage is to find out an outline of what will be done in making the BatikBot chatbot.

D. Construction
The next stage is the process of converting the modeling into code that can be read by the program [18]. This coding uses the AIML language, which contains several patterns and responses that the chatbot uses to provide answers to each command given. After the coding is complete, testing of the virtual assistant that has been made is carried out. This test uses Black Box Testing, where testing is done to find out whether the chatbot can run well or not.

E. Deployment
The last stage is deployment, which will be carried out to launch the application made after the testing stage is declared successful and so that it can be used by users [19]. At this stage, the BatikBot chatbot will be launched to users, namely batik sellers, and evaluate and develop virtual assistants based on the feedback provided.

III. RESULTS AND DISCUSSION
A. Analysis of Current Procedure
A detailed analysis of the current procedures is essential to understand how the information exchange process is currently handled. This analysis helps

identify potential inefficiencies or areas that can be improved, which will contribute to the development of the BatikBot chatbot. By examining the existing methods, it becomes possible to determine the challenges faced by customers and administrators in obtaining and providing information.

Figure 2. Use Case Diagram of Current Procedure.

Figure 2 presents the Use Case Diagram of the Current Procedure, which outlines the communication process between customers and admins. Currently, customers interact directly with the admin by sending messages containing questions about batik-related topics, such as product details, prices, sizes, discounts, and shipping. The admin then responds to these queries manually, ensuring that the customer receives the necessary information.

While this process allows for personalized responses, it can be time-consuming and inefficient, especially when handling a large number of customer queries. Admins may experience delays in responding to messages, leading to slower customer service and potential dissatisfaction. Also, repetitive questions may require admins to provide the same answer multiple times, which can be automated to improve efficiency.

B. Programming Planning

BatikBot chatbot is designed to provide information to customers more quickly, efficiently, and practically. Previously, this process was done manually, where the admin had to reply to customer messages one by one. This method is often time-consuming and inefficient, especially if the number of incoming questions is quite large. To overcome this challenge, BatikBot was developed with an automated messaging system that enables instant responses to customer queries. The system works by assigning predefined keywords and answers in its database. When a customer sends a message containing one of those keywords, the chatbot will instantly display the corresponding answer without requiring any intervention from the admin. In addition, customers can easily access BatikBot through the website.

C. Program Design Preparation

The following are the use cases, activity diagrams, and sequence diagrams planned for the BatikBot chatbot. A series of connected exchanges between the actors and the system creates a use case diagram. Use cases are implemented by outlining the kinds of interactions that take place between a program's (or system's) user and the system itself [20]. A software system or process's

workflow or activity is depicted in an activity diagram [21]. A sequence diagram is a visual representation of the interactions that arise from objects responses that communicate with one another. Time is the vertical dimension of the sequence diagram, and related items are the horizontal dimension [22].
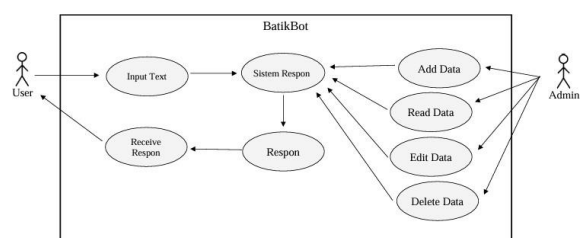
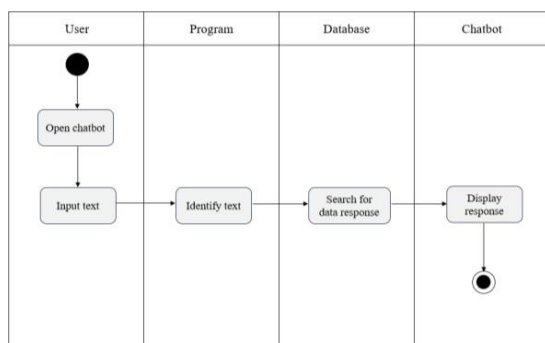

Figure 3. Use Case Diagram for BatikBot Chatbot.

Figure 3 presents the use case diagram designed specifically for the BatikBot chatbot, which illustrates the interaction between two main actors: the user and the admin. In this diagram, the user is responsible for entering text into the chatbot and receiving the corresponding response.

Meanwhile, the admin plays an important role in managing the chatbot database by performing various actions such as adding, reading, editing, and deleting data. This functionality allows the chatbot to provide accurate and up-to-date responses to user queries. By structuring the interaction between users and administrators in this way, the BatikBot chatbot ensures efficient data management and improves the overall user experience.
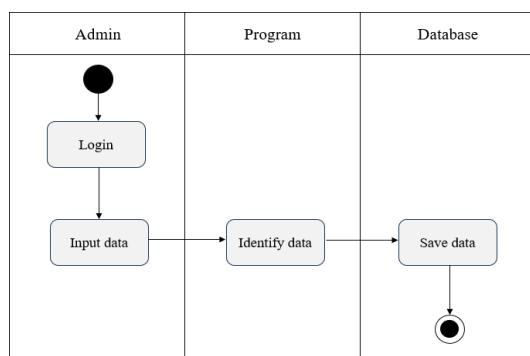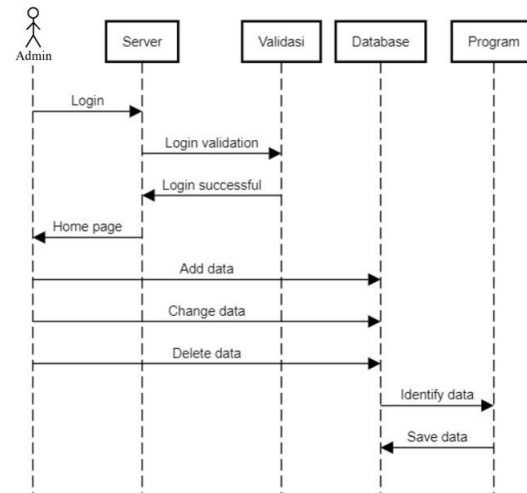

Figure 4. Activity Diagram for Data Input by Admin

Figure 4 presents an activity diagram illustrating the step-by-step flow of the data input process performed by the admin in the system. This diagram explains how the admin logs into the system and proceeds to enter data in the form of keywords and corresponding responses, which are then processed by the program. The program then identifies and verifies the data entered before passing it to the database for storage. This structured workflow ensures that the chatbot system is equipped with the necessary data to automatically generate appropriate responses to user queries.

Figure 5. Activity Diagram for Chatbot

Figure 5 presents an activity diagram that illustrates the process flow when users interact with the BatikBot chatbot by entering text. This diagram describes each step involved, starting from when the user opens the chatbot interface and proceeds to enter a message or question. The system then analyzes and identifies the entered text to determine its meaning or relevance. Once identified, the program queries the database for appropriate responses based on pre-defined keywords and stored data. Finally, the chatbot retrieves and displays the appropriate response to the user, ensuring an efficient and automated interaction.

Figure 6. Sequence Diagram for Data Input

Figure 6 presents a sequence diagram depicting a structured flow of activities in a chronological timeline as the admin performs data input in the system. This diagram details each step that occurs, starting from the admin logging into the system, which involves a login validation process handled by the server. Upon successful login, the admin is redirected to the homepage, where they can proceed with various data management tasks. These tasks include adding new data, modifying existing data, and deleting unnecessary data. The system ensures that each input is processed correctly by identifying the data and then saving it to the database.
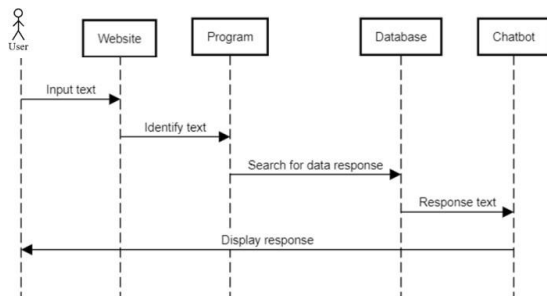
Figure 7. Sequence Diagram for Chatbot

Figure 7 presents the sequence diagram for the BatikBot chatbot, which illustrates the structured flow of activities that occur in a chronological timeline as the user interacts with the chatbot by entering text. The process begins when the user enters a text based query on the chatbot interface available on the website. The system then identifies the text input and passes it to the program for further processing. Next, the program performs a search within the database to find the most relevant response based on pre-defined keywords and stored data. Once a matching response is found, the chatbot retrieves the corresponding response text from the database and sends it back to the user interface. Finally, the response is displayed to the user through the chatbot interface on the website, ensuring an efficient and automated communication process.

D. PROGRAM IMPLEMENTATION

The implementation stage is the advanced stage of the entire design process, where the concepts and plans that have been designed in the previous stage are transformed into a system that functions operationally. The following is the result of the website that has been developed, namely BatikBot.
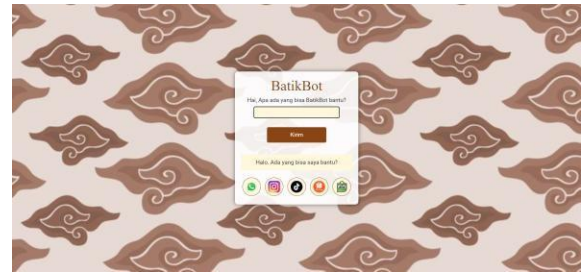

Figure 8. BatikBot Display on the Website

Figure 8 illustrates the user interface when accessing the BatikBot website. On this web page, users are given a text input field where they can type their questions or requests. After the user enters the question, they can proceed by clicking the "Submit" button. After submitting, BatikBot will create and display a response to the user's query. In addition, the interface features a visually appealing batik-patterned background, which enhances the platform's cultural identity. Below the input section, there are several icons that likely serve as quick access links to other relevant social media platforms or resources.
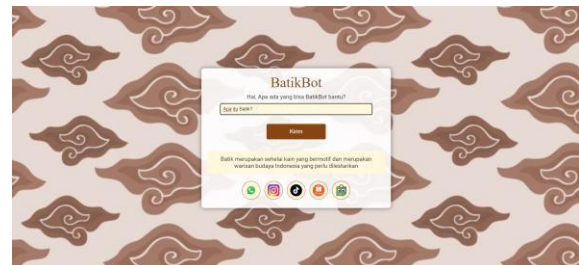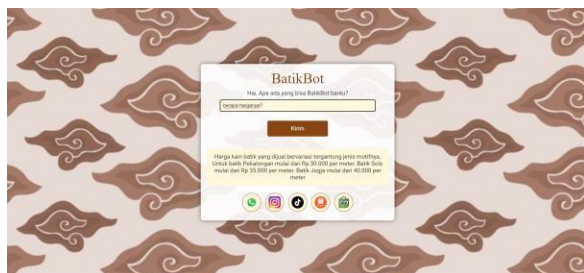

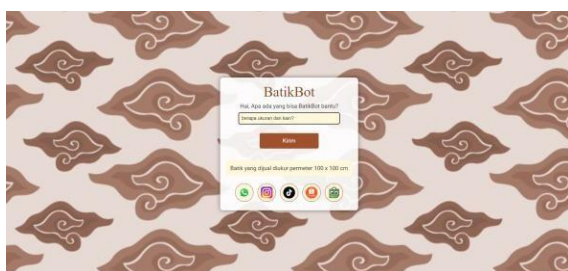**Figure 9. Input Question about Batik**

Figure 9 illustrates the display that appears when a user enters a batik-related question, specifically one containing the keyword "batik". After users type their question into the input field and click the "Submit" button, BatikBot processes the query and generates relevant responses. In this example, BatikBot provides an explanation of batik, describing it as a patterned fabric that has cultural significance and is recognized as an important Indonesian heritage that must be preserved. This feature allows users to get informative answers related to batik directly through the chatbot.

Figure 10. Input Question about Price (Harga)

Figure 10 illustrates the display that appears when a user inputs a question related to price, specifically containing the keyword "price". After the user types their question into the input field and clicks the "Submit" button, BatikBot processes the query and generates a relevant response. In this example, BatikBot provides information about the price range of batik cloth, explaining that the cost varies depending on the type and motif of the batik. The response includes specific price examples, such as Pekalongan batik starting from IDR 30,000 per meter, Solo batik starting from IDR 35,000 per meter, and Jogja batik starting from IDR 40,000 per meter. This feature allows users to get detailed and informative price insights related to batik fabrics directly from the chatbot.

**Figure 11. Input Question about Size (Ukuran)**

Figure 11 illustrates the display that appears when a user enters a question related to size, specifically containing the keyword "ukuran" (size). When the user types their inquiry into the input field and clicks the "Kirim" (Send) button, BatikBot processes the request and generates a relevant response. In this example, BatikBot provides information regarding the standard dimensions of batik fabric available for purchase. The response states

that batik is typically sold per meter, with dimensions of 100 cm in length and 100 cm in width. This feature ensures that users receive clear and concise information about the size specifications of batik fabric, helping them make informed purchasing decisions through the chatbot.
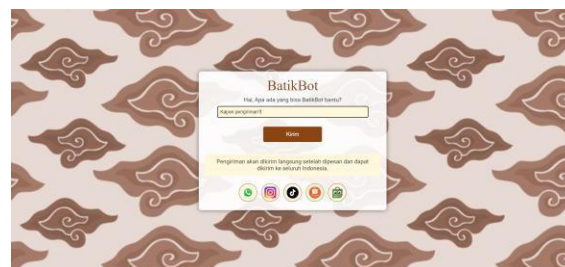
Figure 12. Input Question about Shipping (Pengiriman)

Figure 12 illustrates the interface when a user enters a shipping-related question, specifically one containing the keyword "shipping". After the user types their question in the input field and clicks the "Send" button, BatikBot processes the request and generates a relevant response. In this case, BatikBot provides information related to the shipping process, stating that the order will be shipped immediately after purchase and can be delivered to any location across Indonesia. This feature ensures that users receive clear and timely details about the shipping policy, helping them understand the estimated shipping process and the availability of nationwide shipping options.
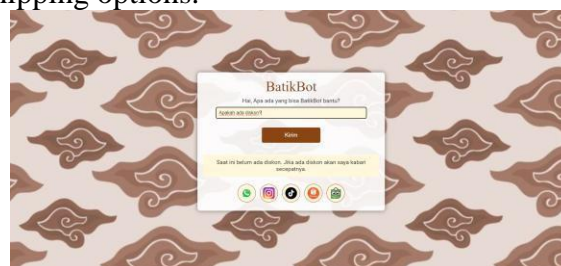
Figure 13. Input Question about Discount (Diskon)

Figure 13 illustrates the interface that appears when a user enters a discount-related query, specifically one containing the keyword "discount". After the user types their question in the input field and

clicks the "Send" button, BatikBot processes the request and generates a response accordingly. In this case, BatikBot informs the user that there is currently no discount available. However, BatikBot also assures users that if discounts are available in the future, they will be notified as soon as possible. This feature ensures that customers are kept informed about promotional offers and encourages them to stay engaged with the platform for future updates on potential discounts.

E. TESTING

After the implementation stage, it continues with the testing stage. The test conducted for the BatikBot chatbot uses Black Box Testing. Black box testing is a software quality test that focuses on the functionality of the software [23]. This test is conducted to determine whether the virtual assistant can run properly or not. In conducting this test, the tester only needs to observe the input and output results of the virtual assistant without knowing the code structure. The test was conducted by batik sellers and BatikBot chatbot developers.

Table 1. Black Box Testing

No	Test Scenario	Expected Output	Result
1	Open BatikBot website	The website can be opened without any errors	[√] Success [ ] Failure
2	Input question about batik	Answers to the keyword batik appear	[√] Success [ ] Failure
3	Input question about price	Answers to the keyword price (harga) appear	[√] Success [ ] Failure
4	Input question about size	Answers to the keyword size (ukuran) appear	[√] Success [ ] Failure

No	Test Scenario	Expected Output	Result
5	Input question about shipping	Answers to the keyword shipping (pengiriman) appear	[√] Success [ ] Failure
6	Input question about discount	Answers to the keyword (diskon) appear	[√] Success [ ] Failure

In particular with relation to user query response accuracy, the table above presents a set of test cases meant to assess BatikBot's performance. Every test case deftly describes the expected outcome, true results, and circumstance. The main objectives of this testing method are to guarantee BatikBot functions as expected and provide pertinent answers depending on specific keywords users input.

Starting the first test case was surfing the BatikBot website. This was a required test to verify free from technical problems the website loads. Good results show that users of the website may communicate with the chatbot without running across problems and move about it error-free. The second test case evaluated BatikBot's general ability to recognize questions and response capability. The chatbot must react exactly when the keyword "batik" is found since it is meant to help consumers find information about the medium. The test results revealed BatikBot generated suitable answers and properly detected the term.

The third test case concentrated on the chatbot's response to questions on pricing. Using the keyword "price," BatikBot was evaluated to see if it could appropriately identify and answer for pricing inquiries. Accuracy is vitally crucial in this field since e-commerce and client choice mostly depend on price. BatikBot answered questions and shown ability to offer pertinent pricing statistics. Similarly, the fourth test case assessed the chatbot's response to inquiries concerning product sizes. In the fashion and textile sectors, particularly with reference to batik, size

significantly influences consumer buying choices. BatikBot responded appropriately and, drawing on the data, chose the word "size".

Considered in the sixth test case was BatikBot's answer to inquiries regarding shipping. The chatbot was tested using the phrase "shipping" to evaluate whether it could provide pertinent information on pricing issues, delivery times, or shipping choices. The results clearly let BatikBot identify and answer issues about shipment. At last, the sixth exam scenario concentrated on issues about discounts. Promotions and discounts are the main motivators for customers; so, BatikBot should present reliable information on the current offerings. BatikBot validated by generating pertinent discount information when users requested about it.

BatikBot especially detects and answers user inquiries with an incredible degree of accuracy, especially when users enter particular keywords related to batik and its commercial attributes. Usually fulfilling expectations, the chatbot's performance suggests that its system is designed to offer accurate and fast answers. Test results show

BatikBot often provides the information consumers need whether it comes to batik products, pricing, delivery, or savings. These capabilities allow BatikBot to become a quite useful tool for everyone seeking batik-related information without running across issues all through the search.

IV.CONCLUSION

Analysis and development of the BatikBot chatbot clearly shows that this chatbot is quite important in helping Batik retailers with their customer support procedures. BatikBot helps merchants to more effectively handle customer inquiries without continual personal intervention by providing rapid, accurate, easily available information about items and business processes. By greatly lightening their

responsibilities, this automation frees business owners to concentrate on other important areas of their company, including improving product quality, increasing their market share, strengthening their brand, and strengthening of customer relations.

Apart from helping vendors, BatikBot makes information easily available, therefore enhancing the whole consumer experience. Consumers and possible purchasers no longer have to go through difficult processes or wait for answers from vendors to get specifics on batik goods, pricing, or business-related questions. Users of BatikBot included into the website can access the required information from anywhere at any moment. Customers' rapid informed purchase decisions made possible by this simplicity of access help to raise their pleasure and interaction with the company.

BatikBot is currently in its early phases of development, hence even with its several benefits there is more room for development. Particularly in terms of offering business information services, several areas can be improved to boost its intelligence and efficacy. BatikBot's capabilities should be extended going ahead to include more a wider spectrum of purposes. This could entail adding features like automated order processing, customer feedback collecting, and multilingual support, enhancing its natural language processing (NLP) capacities to enable more human-like interactions, and including a more wide spectrum of keywords. BatikBot would be a better and more flexible virtual assistant if these improvements let it offer more customized, thorough, and engaging answers.

By constantly inventing and increasing its capability, BatikBot has the potential to become a necessary instrument that not only simplifies consumer service for batik companies but also helps the digital transformation of the sector by always improving and extending its characteristics. BatikBot can enable traditional batik vendors remain

competitive in the digital market and adjust to current improvements as technology develops.

REFERENCES

[1]   F. H. Prasetya, B. Harnadi, A. D. Widiantoro, A. N. Hidayanto, and A.C. Nugroho, "Investigating the Impact of System and Service Qualities on Customer Loyalty in Acceptance of E- Marketplace," *2020 Fifth International Conference on Informatics and Computing (ICIC)*,pp. 1–6, Nov. 2020.

[2]   D. W. Harahap and L. Fitria, "Web-Based Chatbot ApplicationUsing Dialogflow Method," vol. 01, no. 01, pp. 6–13, 2020.

[3]   L. V. Oey, R. Sanjaya, and C. Wibhowo, "LINE-based Virtual Friend Development for Borderline Personality Disorder," in *2021 International Conference on Computer Science, Information Technology, and Electrical Engineering (ICOMITEE)*, IEEE, Oct. 2021, pp. 80–85. doi:10.1109/ICOMITEE53461.202 1.9650080.

[4]   E.N Sugianto, J. A. Sujangga, N. Delvia, V. Ayustika, and A. C. Nugroho, "Pengembangan Chatbot'Ciovita' Virtual Assistant Cioccolato Brownie Semarang Dengan Metode Waterfall," *Journal of Applied Computer Science and Technology*, vol. 3, no. 2, pp. 179–185, Dec. 2022, doi: 10.52158/jacost.v3i2.348.

[5]   M. R. Harisi and E. M. Hiwono, "The Effect of Chatbot Usage on Customer Satisfaction," *Jurnal Ilmiah Manajemen Ekonomi Dan Akuntansi*, vol. 1, no. Februari, pp. 66–73, 2024, doi: https://doi.org/10.62017/jimea.v1i2. 33 8.

[6]   M. E. Rianto, Maulidiansyah, and A. Tholib, "Implementation of AI Chatbot as Support Assistant for Nurul Jadid University Website Using Long Short-Term Memory (LSTM) Algorithm," *Journal homepage: Journal of Electrical Engineering and Computer (JEECOM)*, 2024, doi: 10.33650/jeecom.v4i2.

[7]   A. Prasetyo and Singgih,"Characteristics of Kendal Batik Motifs Interpretation of Region and Geographical Location," 2016. [Online]. Available:http://journal.unnes.ac.id /nju/index.ph p/imajinasi

[8]   P. Yasmin and J. Ivanna, "Analysis of Generation Z's Interest in Using Batik as a Fashion Trend", [Online]. Available: https://ummaspul.e-journal.id/Sublim

[9]   S. N. Yanti, "The Use of Chatbots in Improving Customer Experience on E-commerce Sites," *The Serambi Journal of Economics and Business*, 2024, [Online]. Available:https://ojs.serambimekka h.ac.id/seram bi-ekonomi-dan-bisnis/□327

[10]   Kholisatunnisa and D. N. Misidawati, "The Role of AI Technology in Customer Service Chatbot Development," *Jurnal Sistem Informasi, Manajemen dan Teknologi Informasi*, vol. 2, no. 2, pp. 92–97,Jul. 2024, doi: 10.33020/jsimtek.v2i2.689.

[11]   M. Mustaqim, A. Gunawan, Y. B. Pratama, and I. Zaliman, "Public Service Chatbot Development Using Machine Learning and Natural Language Processing," *Journal of Information Technology and society*, vol. 1, no. 1, pp. 1–4, Jun. 2023, doi: 10.35438/jits.v1i1.16.

[12]   P. Dellia *et al.*, "Development of Chatbot-Based Batik Klampar, Pamekasan Selection

Recommendation Information System Using Chatbase Website," vol. 6, no. 4, pp. 608–614, 2023, doi:10.32493/jtsi.v6i3.34003.

[13] H. Kurniawan, W. Apriliah, I. Kurniawan, and D. Firmansyah, "Application of Waterfall Method in Designing Payroll Information System at SMK Bina Karya Karawang," *Jurnal Interkom: Jurnal Publikasi Ilmiah Bidang Teknologi Informasi dan Komunikasi*, vol. 14, no. 4, pp.13–23, Jan. 2020, doi:10.35969/interkom.v14i4.58.

[14] M. P. Putri and B. Bobby, "Web-based Project Management Information System of PT Samudera Perkasa Konstruksi," *MATRIK : Jurnal Manajemen, Teknik Informatika dan Rekayasa Komputer*, vol. 20, no. 1, pp. 85–96, Sep. 2020, doi: 10.30812/matrik.v20i1.716.

[15] S. Entas, "Implementation of Knowledge Management in Shoe Craftsmen Center in Kotabatu Village Ciomas Bogor Regency," vol. III, no. 1.

[16] D. Murdiani and H. Hermawan, "Comparison of Waterfall and RAD (Rapid Application Development) Methods In Information System Development," vol. 6, no. 1, 2022.

[17] D. Ramayanti, Y. Jumaryadi, A. Sunandar, and K. Kolidi, "Implementation of the Waterfall Method in Point of Sales and e-Commerce System Development," *TIN: Terapan Informatika Nusantara* vol. 4, no. 2, pp. 129–133, Aug. 2023 doi: 10.47065/tin.v4i2.4208

[18] Kurniawati and M. Badrul "Application of The Waterfall Method for Designing Inventory Information Systems at Bintang Ceramic Shops," vol. 8, no. 2, 2021.

[19] I. Choldun and R. Rahmadewi, "Application of Waterfall Method on Website-Based Cultural Arts Learning Application Using Reactjs "Application of Waterfall Method on Website-Based Cultural Arts Learning Application Using Reactjs.

[20] Ihramsyah, V. Yasin, and Johan, "Design of Web-Based Fast Food Sales Information System Application Case Study of Cheese.Box Shop," *Jurnal Widya*, vol. 4, no. 1, pp. 117–139, 2023, [Online]. Available: https://jurnal.amikwidyaloka.ac.id/ind ex.php/awl

[21] N. Musthofa and M. A. Adiguna, "Design of Web-Based Computer Spare-Part E-Commerce Application Using CodeIgniter at Dhamar Putra Computer Tangerang City," *OKTAL : Jurnal Ilmu Komputer dan Science*, vol. 1, no. 03, 2022, [Online]. Available: https://journal.mediapublikasi.id/in dex.php/oktal

[22] J. Sutrisno and V. Karnadi, "English Learning Support Application Using Android-Based Song Media," *JURNAL COMASIE*, vol. 04, no. 06,2021

[23] D. Y. Wijaya and M. W. Astuti, "Blackbox Testing of PT Inka (Persero) Employee Performance Appraisal Information System Based On Equivalence Partitions," *Jurnal Digital Teknologi Informasi*, vol. 4, no. 1, p. 2021.