Development and Critical Assessment of a Basic Chatbot Utilizing Watson AI

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# Introduction

Chatbots are software programs designed to simulate conversation with human users, using some kind of chat interface, especially over the Internet. Some of the other terms used to represent chatbots are conversation agents, virtual assistants, and artificial conversational entities. In 1950, Alan Turing introduced the Turing test to test the ability of a machine to exhibit intelligent behaviour. Further, in 1997, Cleverbot by Rollo Carpenter, the first non-rule-based chatbot system on crowdsourcing was introduced where it stores the conversations in a database. This was later followed by customer support or personal assistants like Alexa and ANNA. These conversational interfaces powered by Artificial Intelligence have brought a revolution in various industries by providing personalized assistance, automating tasks, and improving user experiences. Over the years, AI has transformed from rule-based systems to cognitive computing platforms. The driving force behind these advancements has been the breakthrough in natural language processing (NLP), machine learning (ML), and deep learning algorithms. Among the leading platforms in AI-powered chatbots, IBM Watson Assistant was discovered in 2020 and became the strongest tool that empowers developers to create intelligent conversational agents that can understand and respond to natural language queries with speed and accuracy. Watson Assistant stands out due to its extensive set of characteristics, including intent recognition, entity extraction and dialogue management using NLP which got further migrated to actions and variables in Watsonx Assistant in 2023 that uses Large Language Models (LLM) for more contextual aware conversations (*IBM Cloud Docs*, n.d.). Watson Assistant offers an interactive interface and due to its extensive documentation allows developers to quickly build and deploy chatbots. Its versatility and integration with other IBM services and third-party applications, make it a popular choice for businesses across different sectors.

In this essay, we will delve into the development and critical assessment of a basic chatbot utilising Watsonx Assistant called “DocAppEase”, which means doctor’s appointments made easier for appointment scheduling in healthcare settings. By working on Watsonx Assistant's capabilities, the assistant aims to improve patient experiences and collect user feedback for its enhancements. Through a comprehensive evaluation of its performance, we will assess the strengths and weaknesses of DocAppEase, highlighting areas for improvement and opportunities for further innovation.

# Related Work

In a study titled 'Creating domain-specific chatbot using IBM Watson’, Bansal (2021) explored the development of a domain-specific chatbot utilising IBM Watson's modules Understand, Learn, and Interact using Natural Language Understanding (NLU), Discovery, and Tone Analyzer. Another study was conducted that talks about Watson in detail, its applications, and its work in the field of healthcare. This assistant had the feature to make appointments, disease enquiries and nearest hospital information (Kumar et al., 2022). Mr. Dr. Health Assistant crafted by Hossain et al. (2021) is a chatbot in which people with small symptoms are guided with adequate remedies and those with critical symptoms could be scheduled for an appointment with the doctor using NLP. Krishna et al. (2022a) in their paper built an automated chatbot using NLP and Recurrent Neural Network (RNN) algorithm where people can interact with their health queries rather than visiting the clinics personally giving simple prescriptions based on the diagnosis of the disease as well as book an appointment with specialists if necessary. The critical evaluation of the DocAppEase chatbot developed for this study is majorly carried out based on the study done by Jain et al. (2018) on evaluating eight chatbots by sixteen first-time chatbot users qualitatively and quantitatively.

# Developing the Chatbot

## Purpose and Objectives

The purpose and objectives of choosing a chatbot to study the IBM Watson AI capabilities are mainly focused on a domain-specific use case that is essential in day-to-day life. This initiative aims to enhance the patient experience with convenient appointment booking options reducing the administrative burden for healthcare providers and decreasing the efforts to go and book manually. DocAppEase will simplify scheduling appointments with the doctors of your choice, with just a few clicks.

## Why Watson AI?

Unlike conventional approaches to computing that can only handle neatly organised structured data such as what is stored in the database, Watson can understand unstructured data which is typically 80% of the data today primarily produced by humans. Watson relies on natural language that is governed by rules of grammar, context, and culture. Watson not only looks just the keyword matches or synonyms like a search engine, but it also reads and interprets text like an actual person by breaking down a sentence grammatically, relationally, and structurally decerning meanings from the semantics of the written material. Watsonx has three components action, steps, and variables. “An action comprises the interaction between a customer and the assistant about a particular question or request” (*IBM Developer*, n.d.). Steps are defined as the conversations between the user and the agent. Variables refer to the named containers based on the pieces of information inputted by the user.

## Development Process

For this chatbot, I have created 4 actions for book, get to know, feedback and greeting. For the primary action “book an appointment”, we train the model with suitable examples of customer inputs in natural language like “I want to see a doctor”, “I would like to schedule an appointment” etc which will teach and intelligently picks up this particular action based on the NLU capability of Watson AI. Subsequently, we define the next steps of assistant prompting the user to enter the location, hospitals, date, time slot and doctors specialised in different fields. The assistant then asks the user to enter their details like name, phone number and email which is validated using regex. Once all the selections are made, the assistant provides all the details of the booking information for the user to confirm. For this I have used action step variables to retrieve the required details to print the assistant response as “Hi Anna, your appointment will be booked with Dr. John Samuel at 10:00 on May 14, 2024, in the Aintree University Hospital”. Fallback options are set if any unrelated input or the user chooses the ‘Other’ option. Detailed performance is discussed in the evaluation section.

# Critical evaluation of the Chatbot

## Key Features and Functionality

DocAppEase provides a versatile interaction containing both option-based selection and textual input. Unlike Pandorabots *which* lacks interactive elements as it is an entirely text-based chatbot and Trivia Blast is completely click-based (Jain et al., 2018), DocAppEase stands out with its hybrid method which ensures a dynamic and flexible experience for the users. The bot performs all the functionality that is explicitly defined in the “Get to know DocAppEase”. It outperforms the traditional booking process thus saving time and effort. If users are unsure what to select, it has the option “Other” which could allow users to talk to an agent. It would be better if our assistant prompted users to provide descriptions of their health condition, giving personalised recommendations or remedies which is an innovative feature that helps to understand the extent to which the LLM within Watson AI can interpret the natural text to meaningful context-specific recommendations that could enhance the usefulness. Allowing users to choose hospitals based on their current location other than Liverpool alone will provide a more personalised experience. This would mean the assistant automatically prompts the users to turn on their location and suggests hospitals in the proximity.

## Conversational Intelligence

DocAppEase attempts to match human-like conversations by employing Natural Language Understanding to interpret user input involving in conversation with humans in a turn-taking manner to facilitate conversational flow. For instance, even if you type a grammatically incorrect sentence or typo like “see doctor”, it will identify it as book action. Contextually unrelated input will either redirect to an agent or ask you to rephrase your question based on the system's intelligence. It will be irritating to the users if the chatbot responds this way more times. So, in DocAppEase, it acknowledges user limitations gracefully if it doesn’t understand twice and redirects to the live agent during the third attempt. Regarding context-preservation like remembering the previous interaction and user preferences, the chatbot is not built to store user data to respond based on the saved data nor have I used session variables which is something that could be improved. DocAppEase don’t identify the medical terms as it is not trained with suitable examples, and it also tends to direct to actions that are not suitable for some phrases which are a few of its limitations. It is evident to note that this chatbot asks relevant questions to gather as much information that makes it personalised for the user.

## Personality and Tone

Users expect chatbots in healthcare to exhibit traits like professionalism and empathy that are displayed through their style and tone. Incorporating professionalism, DocAppEase addresses users by their name in responses adding a personalized touch to interactions. It understands the significance of advertising its services ensuring transparency and clarity through its “Get to Know DocAppEase” option. In addition to that, this conversational agent is also designed to respect users’ need for closure which is depicted by it asking the user to close chat or continue with their appointment which will end the conversation with a positive response or reiterate previous steps as per user need. For repeated prompts, it displays different sentences showcasing its health-related concerns taking a caring tone.

## User Experience and Interface Design

DocAppEase assistant has utilized the web chat code snippet for users to interact directly with the chatbot through the website (*IBM Developer*, n.d.) The web chat feature allows quick embedding in a website which helps users to conveniently schedule appointments through healthcare websites. To make DocAppEase an easy-to-use assistant, users are greeted with a pleasant and visually appealing interface that guides them smoothlythrough their appointment booking process. It is interesting for the bot to show its main menus persistently if it feels the conversation is not taken further like in our agent where the assistant prompts to book an appointment or close chat. As mentioned by Jain et al. (2018, p. 903) “The application should also be restricted to the chat interface, as adding links to external webpages is not recommended”, this chatbot is also not having any links to make it provide all details within the chat interface.

# Future Enhancements and Roadmap

Currently, DocAppEase assistant using IBM Wastsonx Assistant has been integrated into website users alone. However, if it is integrated into third-party messaging platforms like Facebook Messenger, WhatsApp etc it would provide alternative channels for user interaction. It would also be great if DocAppEase is integrated into a payment system which is another capability that Watsonx AI assistant is offering. Sending out email and SMS reminders about the scheduled date and time would make DocAppEase a more user-friendly and mindful assistant. It would be ideal if the chatbot had the necessary features to upload medical reports to book an appointment with an appropriate doctor or provide some useful remedies based on the criticality of the health condition. Finally, it would be an addition to have a multilingual response as well as voice interfaces that would help users to chat in their language or to provide an option for users to select their language preference and the chatbot displays the language preferred by users.

# Conclusion

In conclusion, DocAppEase, a healthcare appointment scheduling chatbot powered by IBM Watsonx Assistant, represents the capacity of AI-driven conversational agents in healthcare. Through an interactive interface and intelligent actions, DocAppEase facilitates appointment bookings, outperforming traditional methods. It demonstrates professionalism and empathy, addressing users' needs while guiding them through the process with ease. While DocAppEase excels in functionality and user experience, integrating with third-party platforms, enabling a voice interface, and implementing payment processing could extend its usability.

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# Appendix

The following link provides access to the preview version of the DocAppEase chatbot developed for this study:

[Chatbot Preview Link](https://web-chat.global.assistant.watson.appdomain.cloud/preview.html?backgroundImageURL=https%3A%2F%2Feu-gb.assistant.watson.cloud.ibm.com%2Fpublic%2Fimages%2Fupx-f139714f-9ceb-4b18-afd8-ff15a08604f3%3A%3Ae8aa74f6-c9fd-4b8f-8c1b-4a3bbe70b74a&integrationID=b8106469-3210-4fa2-a42b-7e24e1a8b562&region=eu-gb&serviceInstanceID=f139714f-9ceb-4b18-afd8-ff15a08604f3)