Server-Based Universal Bank Chatbot

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Abstract. A chatbot is an artificial intelligence (AI) system that mimics human-like conversations through text chat or voice commands. It can be integrated into messaging applications to provide customer service and support, and many companies across various industries have implemented Chatbots to interact with their customers. However, creating and maintaining a personalized Chatbot can be a complex task that requires a team of Machine Learning experts and a dedicated server that operates continuously. To overcome this challenge, the paper proposes a Universal Chatbot hosted on a server, which can be accessed by multiple companies through a secure pin. Universal Chatbot is designed to have all the necessary features and capabilities that a company would require, making it easily integrable with their existing applications using the server's IP address and login credentials. Additionally, companies can individually personalize the system to meet their specific requirements, and the system updates itself through its machine learning process, providing updated responses. The Universal Chatbot system utilizes a Random Forest machine learning algorithm with an accuracy rate of 92.0%, making it a reliable and efficient solution for companies to provide customer service and support. By implementing the Universal Chatbot, companies can benefit from a streamlined and cost-effective solution that requires only the integration of the Universal Chatbot with their existing applications.

Keywords: chatbot · bank · python · universal · machine learning

1 Introduction

Chatbots have become increasingly popular in recent years, as they allow businesses to provide 24/7 customer service and automate repetitive tasks. According to a report by Markets, the global chatbot market size is expected to grow from USD 2.6 billion in 2020 to USD 9.4 billion by 2025, at a CAGR of 29.7% during the forecast period. This growth is driven by the increasing adoption of chatbots in various industries, such as healthcare, banking, and e-commerce, as well as advancements in natural language processing (NLP) and machine learning (ML) technologies.

The use of chatbots in different industries is also increasing. In healthcare, chatbots are used for appointment scheduling, symptom checking, and providing general health information. In banking, chatbots are used for account management, fraud detection, and

B. Raj et al. (Eds.): ICETE 2023, AER 223, pp. 516–525, 2023.
https://doi.org/10.2991/978-94-6463-252-1_54

answering customer queries. In e-commerce, chatbots are used for product recommendations, order tracking, and customer service. The amount of revenue spent on chatbot is also increasing year on year. According to a report by Grand View Research, the global chatbot market size was valued at USD 923.1 million in 2019 and is expected to expand at a compound annual growth rate (CAGR) of 24.3% from 2020 to 2027. The increasing adoption of chatbots in various industries is expected to drive market growth.

In summary, the chatbot industry is growing rapidly with increasing adoption across different industries, and more and more revenue is being spent on it each year. With advancements in technology and increasing demand for automation, the chatbot market is expected to continue to grow in the future. AI-powered chatbots are being used by banks and credit unions to streamline daily banking and improve the client experience. Conversational interfaces with virtual assistants for automated support now allow tasks that used to be accomplished by speaking to a human in a branch or on the phone to be completed in real time. With the help of these banking chatbots, financial organizations may communicate with millions of consumers simultaneously and proactively notify them of potential problems or upcoming payments.

The proposed system offers clients a multichannel chatbot experience, allowing them to perform various actions such as checking their credit card limit, changing their address, and stopping recurring bills. The Chatbot System is a server-based application that uses machine learning algorithms to analyze and respond to user queries related to the banking industry. One of the key features of the system is the ability to integrate the chatbot into various platforms and applications using the server's IP address and authentication pin. This allows for flexibility and customization in terms of the user interface and ideas. Additionally, the system includes an Update-Bot function which enables users to update the chatbot with their own projects without having to worry about the training and deployment process. The system is designed to handle multiple users simultaneously and allows for new users to be added to the system. To ensure security, a randomly generated password is provided by the server for each new user to access Chatbot. The system will serve multiple users at the same time, making it more efficient and cost-effective.

2 Literature Review

Chatbots have become increasingly popular in recent years, with organizations across a variety of industries adopting them as a cost-effective and efficient way to interact with customers. The following literature review examines the applications of chatbots and their benefits in different domains, as well as the challenges and limitations associated with their development and implementation.

The system proposed in [1], the development of a chatbot feature for Matrusri Engineering College using Artificial Intelligence and Machine Learning technologies. The [2] discussed the benefits and implications of chatbots, which are intelligent systems developed through artificial intelligence and natural language processing algorithms. The system in [3] utilizes ontology-based dialog strategies, linguistic and cosine similarity, and data integration from various sources to create an intelligent question management program. The authors conclude that chatbots have a wide range of applications in different domains, making them an efficient tool for obtaining information. In [4] developed

a chatbot, EASElective, to assist students in elective course selection. The [5] surveyed chatbot users in the US and identified productivity, entertainment, social and relational factors, and curiosity as the key motivating factors. The findings provide valuable insights into the reasons why people engage with automated agents online and can inform the design of more effective chatbot interactions. The study contributes to addressing the research gap in investigating the motivational factors related to the use of conversational interfaces and can guide the development of chatbots as a new paradigm in human-data interaction. Another study conducted by [6] that explores the trends and recent developments in chatbot systems across various domains. The study recommends further research in natural language processing to develop more accurate chatbot systems, including exploring machine learning or deep learning methods. Chatbot application proposed in [7] that employs bigram-based sentence similarity calculation to match user input and provide relevant responses. The system proposed in [8] utilizes social network data, specifically Twitter, for sentiment analysis. Natural Language Processing (NLP) techniques such as semantics and Word Sense Disambiguation are used to extract features from tweets, and an Ensemble classifier is applied to classify the data as Positive, Negative, or Neutral. The ensemble classifier outperforms traditional machine learning classifiers by 3–5%, and the Extremely Randomized Trees classification method is the best-performing ensemble method. A University Counselling Auto-Reply Bot using natural language processing (NLP) techniques and a Feedforward neural model developed by [9] to assist users with engineering-related queries at the university level. The chatbot underwent hyperparameter optimization and two phases of end-user testing, resulting in an improvement in the probability score of correct responses in the second phase. The authors suggest that AI-based chatbots in education and counseling can offer personalized and efficient query solutions, leading to time and resource savings. However, chatbots cannot replace humans until they are capable of understanding human emotions and perceptions, particularly in healthcare. The [10] discuss the challenges of developing chatbots that can communicate with humans effectively using natural language processing (NLP). They review generative-based and retrieval-based chatbot models, which have been replaced by end-to-end trainable neural networks due to recent advances in deep learning and AI. Advanced neural networks methods such as RNN, deep CNN, LSTM, restricted Boltzmann machines, and deep auto-encoder should be explored for further chatbot development. The [11] investigated the use of a Chatbot for automated grading and found a strong agreement between the Chatbot's grading and the human instructor's grading. An overview of chatbots and their evolution, applications, and classifications provided in [12]. A web app chatbot developed by [13] utilizes Microsoft's cloud service platform and machine learning AI, with natural language processing through LUIS. The chatbot accurately solves user queries by detecting intents and entities based on the highest prediction score. It provides valuable information for users and developers to understand chatbots and use them appropriately. Future research could explore existing chatbot platforms, compare their functionality, and investigate ethical issues related to chatbots. A spam classification system [14] developed using NLP and URL filtering to address the increasing amount of unsolicited bulk emails in business communication. Naive Bayes and Support Vector Machine algorithms were used for text classification, and a list of spam trigger words and blacklisted URLs were

used to train the model. The system achieved high accuracy, precision, recall, and F1 score. The [15] developed a Question Answering (QA) system using machine learning models based on the SQuAD dataset. The second model was the most accurate, with a score of 70.02% on training and 66.03% on testing datasets. Future work may include the integration of speech recognition into the chatbot.

The system proposed here addresses the significant challenge of creating individual chatbots for each user within the same industry. Instead, the chatbot is hosted on a server that can serve multiple clients, enabling them to integrate the chatbot directly into their own applications. This approach reduces the need for each client to develop and maintain their own chatbot and provides a more scalable and efficient solution. The chatbot can be accessed via a web socket and is designed to be easily integrated into different software systems. This approach also allows for customization and personalization of the chatbot's behavior and functionality based on the client's specific requirements.

3 Proposed Framework

The Chatbot System is a Server-based approach that responds to user queries pertaining to the banking industry. Initially, the system establishes a TCP connection to the server, which prompts the user to authenticate themselves before gaining access to the Chatbot. Once authentication is successful, a chat window appears on the client UI, and the system greets the user and requests their questions. The user can then provide a brief elaboration of their query to the System. The system utilizes its Machine Learning Algorithms to analyze the query provided by the user. The Detailed Architecture of the Chatbot is depicted in Fig. 1.

After receiving the query from the user, the System proceeds to break it down into multiple parts due to the possible variations in how users can phrase their questions. This is done to ensure that the System can determine the exact meaning of the query and extract the relevant keywords that indicate what the user wants to know. To achieve this, the System passes the extracted keywords to a Pre-Trained Supervised Machine Learning Algorithm, which searches through its database for an appropriate response. If the algorithm can find a suitable response, the System delivers it to the user. However, if no suitable response is found, the System will provide the user with predefined responses.

Users can perform various actions such as asking questions, customizing the Chatbot to meet their specific needs, and so on. A detailed explanation of these operations can be found in Fig. 2.

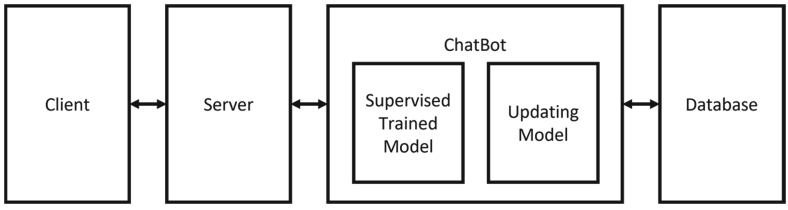

Fig. 1. Chatbot Architecture

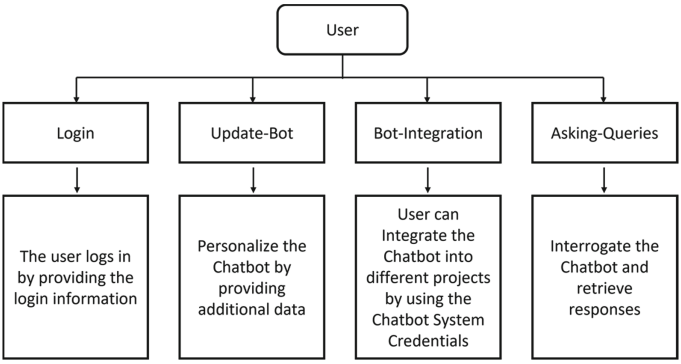

Fig. 2. Roles of the User

Login. Upon launching the chatbot user interface (UI), the client initiates a connection to the server. The server generates a random secret pin that is used as a password to ensure authorized user access. The UI displays a password dialogue box as illustrated in Fig. 4. After entering the password, the user clicks the "Login" button on the UI. The server authenticates the user and opens the chat window as displayed in Fig. 5. The chatbot system greets the user, and they can then start interacting with the chatbot.

Update-Bot. The Chat Window has a button labeled "Update Chatbot" that triggers the appearance of a new window called "Update Chatbot," as shown in Fig. 6. Within this window, the user has the option to upload a CSV file that contains the query and its relevant data, as well as the corresponding response that the Chatbot should provide when encountering that specific query or question. The server analyzes this data using natural language processing and machine learning algorithms, which allows the Chatbot to update its responses accordingly. Once the Chatbot finishes updating, the user is notified, and they can now receive responses to the newly added query.

Bot-Integration. The proposed system employs a methodology that enables users to incorporate the Chatbot into their projects by utilizing the server IP address and authentication pin. Users can customize the Chatbot by integrating it with their UI and implementing their own ideas. The Chatbot can be updated via the "Update-Bot" feature. This approach allows users to utilize a single Chatbot across multiple projects without being concerned about the training and deployment process.

Asking Queries. The Chatbot greets the user and prompts them to ask a question. It then generates an appropriate response. The user's query is sent to the server, where it is processed by a pre-trained supervised algorithm. If the user's query is clear and understandable, the Chatbot provides a relevant response. If the query is unclear or the Chatbot is unable to generate a suitable explanation, it returns with a pre-set message.

On the other hand, the server is responsible for maintaining the Chatbot system and it has various functions to perform such as responding to user queries, authenticating the user, and other functions. The server is designed to analyze user input, retrieve the necessary information, and generate an appropriate response. It also performs functions such as updating the bot's knowledge base, managing user access to the system, and

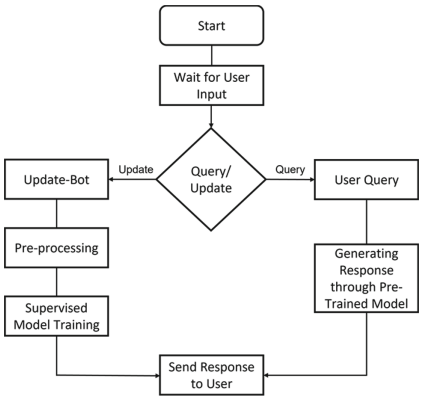

Fig. 3. Flow of the Server

other important tasks. All the functions performed by the server are outlined in detail in Fig. 3.

Login. The system stores all valid user credentials in an encrypted form in the database. The encryption is done using the cryptography package of Python, which employs a symmetric encryption technique. When a user enters their password, the system compares it to the database and confirms the user's identity, allowing them to proceed with further operations.

Adding New User. The system is capable of handling multiple users simultaneously, which allows for the addition of new users. The "Add New User" command generates a random password for the new user, enabling them to access the Chatbot.

Updating Bot. The system receives a dataset of queries from the user. Before training the chatbot, the system pre-processes the dataset. The Chatbot initially removes punctuation marks and common words from the user's input. It then performs tokenization and lemmatization on the remaining words in the user's query. Tokenization involves breaking down a text or a group of text into separate words or sentences. Lemmatization, a variation of stemming, involves grouping together different inflected forms of a word so they can be analyzed as a single item. After that, the system identifies parts of speech and extracts meaningful and relevant keywords, storing them in the dataset. This newly created dataset is then passed to a supervised machine learning algorithm for training. Once the training is complete, the updated algorithm replaces the previous one, and the user is notified that the updating process has been completed.

Query Responding. Once the system receives a query from the user, it breaks down the question into multiple parts. The question's description can vary depending on the context of the user, and different users may phrase the same question in various ways, some asking it in a simple and straightforward manner, while others may ask it in a more elaborate and complex form. To understand the exact meaning of the query, the system uses natural language processing techniques to identify the keywords in the query, which helps the system understand what the user wants to know. The system then passes these keywords to a pre-trained supervised machine learning algorithm. The algorithm

generates a suitable response, otherwise, the system provides the user with predefined responses.

All these functions give the user control over the system without the need to worry about the database.

4 Results

The proposed Universal Chatbot system offers an accessible and flexible solution for companies looking to implement AI chatbots for customer service and support. The system's high accuracy rate, coupled with its customization features, provides a unique advantage in the industry.

The Login Window shown in Fig. 4 allows users to enter their login credentials, which the server will review and authenticate. If the credentials are valid, the server will send a status message to the Login Window indicating that the user has been authenticated and can now access the chatbot.

The Chatbot Window shown in Fig. 5 provides users with an interface to enter text content for the chatbot to process. The Server analyzes the query and generates a response, which is then displayed to the user. This flow of communication allows users to interact with the chatbot in a natural and intuitive way, while the Server's machine-learning algorithms ensure that the chatbot provides accurate and useful responses to the user's queries.

The Update Chatbot Window shown in Fig. 6 allows users to customize and update the chatbot according to their needs. It accepts a CSV file and processes the data to update its algorithm. It also sends the status of the update, indicating whether it was successful or not. The Server Command Window shown in Fig. 7 is an essential tool for administrators to control and manage the server, allowing them to start, stop, and add new users. It is essential for the efficient and secure operation of the server.

The accuracy of four different classifiers was compared for their ability to classify customer queries in the chatbot system. The classifiers tested were Multi-layer Perceptron (MLP), Random Forest (RF), Support Vector Machine (SVM), and Linear Support Vector Machine (LinearSVC). Among these, the RF classifier was found to have the highest accuracy of 92%, followed by SVM with 89%, LinearSVC with 88%, and MLP

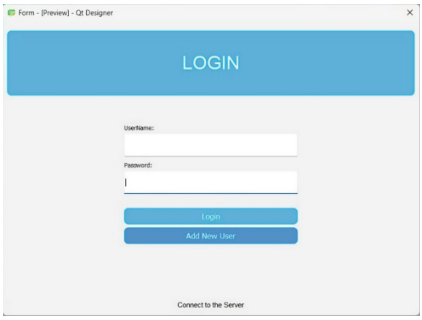

Fig. 4. Login Window

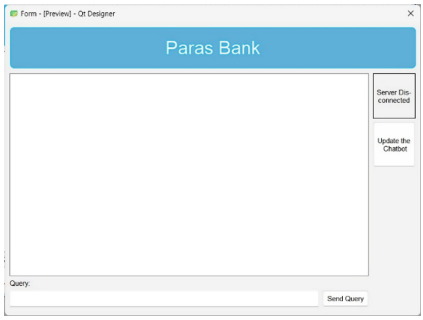

Fig. 5. Chat Window

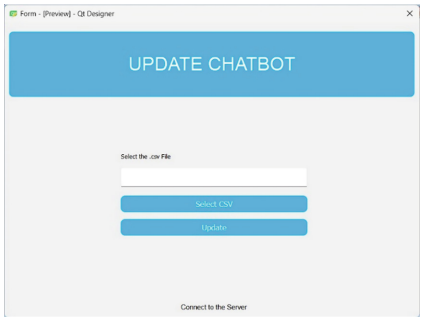

Fig. 6. Update Window

Fig. 7. Server Window

with 81%. Based on these results, the RF classifier was chosen for implementation in the chatbot system as it provided the highest accuracy for the classification of customer queries.

5 Conclusion

Based on the research and analysis presented, it can be concluded that the development of a Universal Chatbot hosted on a server can provide a scalable and efficient solution for companies to offer customer service and support. The proposed system allows multiple

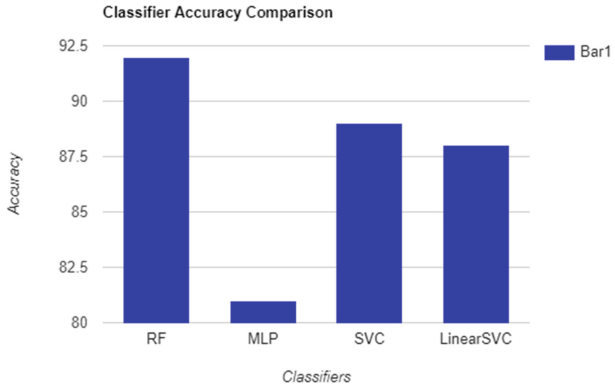

Fig. 8. Model Comparison

companies to access the same chatbot through a secure pin and integrate it into their own applications, reducing the need for each client to develop and maintain their own chatbot. The system utilizes a Random Forest machine learning algorithm, which has an accuracy rate of 92%, making it a reliable and efficient solution for companies. Users can also personalize the system to meet their specific requirements, and the system updates itself through its machine learning process, providing updated responses.

In terms of technical details, the system uses a web socket to access the chatbot, and a password authentication system ensures that only authorized users can access the server. Users can add their own data to the system through a CSV file and update the chatbot as needed. Additionally, the system includes a chatbot UI with various functions, such as updating the chatbot, customizing it to meet specific needs, and asking questions. Overall, the proposed system offers a streamlined and cost-effective solution for companies to provide customer service and support through a universal chatbot. The system's ability to personalize and update itself through machine learning algorithms provides a significant advantage over traditional chatbot solutions, making it an ideal choice for companies across various industries.

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