

# An Intelligent Interactive Chatbot for Handling Academic Queries

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**Abstract**—A chatbot is one kind of software developed to enable interaction using natural language processing between a user/human and a system. Many systems today are equipped with chatbots for interpreting user questions and providing the right answers in a fast and efficient manner. In this paper, we propose a method to develop a chatbot for academic-specific data access for the college, through a simple mobile application. The proposed work aims to build an Artificial Intelligence (AI) chatbot to access information related to students' inquiries towards their academic scores, attendance status, and other general and college-specific data. This chatbot application eliminates any human intervention in the process of student data retrieval. Furthermore, the application guarantee time optimization by not relying on having an active internet connection and reduces delay in navigation through the existing conventional website. Questions can be asked by students to the chatbot at any time of the day and quick responses are generated. Students can have conversations simultaneously with the help of a chatbot which works 24x7. Through natural language understanding, the chatbot extracts meaning, intents, entities, and context from conversational textual inputs.

**Index Terms**—Chatbot, Rasa framework, Intrabot, Artificial Intelligence, Natural Language Processing.

## I. INTRODUCTION

A chatbot computer program uses AI and natural language processing (NLP) to understand human queries and automate responses to them, stimulating human conversation. It provides users with virtual assistance. Usually, chatbots are seen to be spent time on, mainly for entertainment purposes. Relevant entities can be extracted by chatbots by analysing and defining the intent of the user's request. The natural language processing capability of chatbots, to automate responses to conversational texts, promotes a wide range of its applications. The proposed method puts forward an android ai chatbot application that enables students to have human conversations with the bot, which generates efficient responses to any academic-related data of that particular student at any time of the day. The application's feature is further extended to answer any general real-time information in an instant and user-friendly manner. As students, college academic data are required during the course time. We have an 'intranet' website traditionally where we can navigate through webpages regarding our university scores, internal results, attendance details and other similar information. The process undoubtedly relies on the need of having an active and stable internet

connection, re-login on each page refresh, and time delay on browsing for required content, reflecting poor user experience. Instead, an AI chatbot can serve this purpose more efficiently. Human intellect simulation in instruments is related to AI which is programmed to behave like humans imitating their actions. Chatbots make use of machine learning to accomplish AI, helping them to understand conversational user queries and to provide efficient responses. The chatbot we developed is an Android mobile application, that eliminates any human intervention and optimizes time to efficiently retrieve any general or academic-specific data as and when required by any student, simultaneously. For the students, the app does not require an internet connection. Furthermore, the 'one-time login' feature of the application addresses the problem of logging out from the traditional website on refresh or closing it. Students can update their academic-related information with the aid of this technique. This technique is developed aiming to provide a personalized user experience to students, optimizing time for access to required data, through human language textual inputs.

## II. LITERATURE REVIEW

In 2021 R. Parkar, Y. Payare et.al [1] proposed an interactive college enquiry chatbot which is AI and web-based to provide information about a college. NLP and AI techniques were used by the chatbot to engage in conversations with users and answer their queries. It aims to reduce the time and effort required for students to gather college-related information by providing quick and accurate responses. The system utilizes a feedforward neural network model trained on a dataset of questions and responses. The chatbot's interface is designed using HTML, CSS, and jQuery. Overall, the system aims to improve efficiency, reduce paperwork, and enhance the user experience for college students.

In 2022 Chiara Valentina Misischia, Flora Poecze et.al [2] proposed a system which examined chatbot's relevance and impact on service quality in the context of customer service. It highlights the increasing implementation of chatbots in e-commerce and e-services, as they offer opportunities to enhance customer service. The study provides a key features overview and functionalities of chatbots based on review literature, emphasizing their importance in customer service. The authors introduce two categories of chatbot objectives: "ser-

vice performance improvement” and ”customer expectations fulfilment.” Under these categories, chatbot functions related to interaction, entertainment, problem-solving, trendiness, and customization are discussed. The positive influence of chatbots on service quality and their potential in customer service are emphasized.

In 2017 B. R. Ranoliya, N. Raghuwanshi et.al [3] proposed an approach where virtual assistant chatbots are developed using AI-like human conversation. Entertainment, education, healthcare, etc. are the various approaches where it can be used. The business sector is one of the many sectors where chatbot has been beneficial where the customer service cost can be immensely reduced and also lots of users can be handled at a time. The efficiency of the chatbot for this purpose has been increased through this work. A chatbot has been developed which gives us the exact query-based answer. Artificial Intelligence Markup Language (AIML) and Latent Semantic Analysis (LSA) are used for developing this chatbot. AIML answers the basic greetings whereas LSA answers the other questions. Students can use this chatbot to get the University related FAQs answers. The proposed methodology has a drawback in that for preprocessing the data NLP can be used so that for training meaningful data can be used by the model and users’ queries can be provided by an accurate answer.

In 2019 N. P. Patel, D. R. Parikh et.al [4] proposed a work which develops an AI-based chatbot. To get information about the admission process or activities taking place in college, often students have to visit the college etc. Collecting this information is a tedious and time-consuming process. A chatbot was developed to surmount this issue. The proposed method helps us to have an interactive conversation with the user. There are advantages like reduction of time for travelling and anytime and anywhere access. The PHP language is used to develop the chatbot and the concept of AI and ML are used. The chatbot has a graphical interface which is close to that of a messaging app. Drawbacks for the proposed Unibot are like user twisted queries cannot be comprehended correctly as SQL queries are used to fetch the answers. As a result, the greatest alternative will be AI to comprehend the questions of users and for getting the most relevant solution.

In 2021 Delphin Lydia, Ms. J Sangeetha Priya et.al [6] developed an AI-based virtual assistant which deals with college management system queries. Phrases are recognized by a chatbot using the information stored in its database and as query response decisions are made. The Rasa NLU framework [5] is used to build the college inquiry chatbot which understands the text message to analyse user’s queries. The user provides the input sentence which is matched to give the response. The public user portal and student/staff portal are involved in the college management system. The information regarding students and the college is tracked and recorded. In the public, without physically visiting the campus the chatbot is used to ask any college-related questions. The query is analysed by the Bot which responds with a graphical user interface appearing like a conversation between a real person

and a user. The accuracy of the system is estimated to be 95 percentage and the response creation time corresponds to the response line number.

In 2017 Hiremath, Guruswami et.al [7] implemented an automated system which on behalf of a human gives a reply to a user for the education system. For every query answer can be given to the end user. The proposed method focuses on the local and the web database and also on getting a user-friendly, scalable and highly interactive system. To improve system performance, the proposed work uses various techniques such as machine learning, NLP, pattern matching and data processing algorithms. An automatic response-giving system is developed which answers questions asked by students. AI and ML is used for implementing this system.

In 2023 Thu, Cao Hoai et.al [8] proposed a method for integrating a state-of-the-art language model ChatGPT, developed by OpenAI with the learning platform online in Vietnam. The proposed approach aims to use the integration associated with potential benefits and challenges. By integrating the online learning system with ChatGPT in Vietnam we get an opportunity for improving the learning experience and for creating a personalized interactive learning environment. However, challenges related to language, performance, and accuracy can be overcome Based on technological advancements and the efforts and investments of stakeholders, challenges related to language, performance, and accuracy can be overcome.

In 2023 Chokri Kooli [9] published a work which explores AI systems and chatbots’ potential use in the academic field and their education and research impact from an ethical perspective. The researcher performs exploratory research and data collection through a qualitative methodology based on interpretation and expert analysis. In research and education, the researcher conducted a detailed review of the chatbot use challenges. This explorative work provides a foundational understanding of the studied topic. It also helps us to better understand the subjective experiences and perspectives of the observed phenomenon, uncovering their meanings and potential solutions to the observed issues proposed. The pros and cons of AI systems and chatbots were examined, as well as how well they support judgment and human expertise. Chatbot and AI systems-related ethical challenges in research were studied.

In 2020 Hrushikesh Koundinya K, Ajay Krishna Palakurthi et. al [10] proposed a methodology to create an application programming interface (API) for an engineering college. This work investigates how services are improved by enhancements in ML and AI technologies. Chatbots are implemented as a pathway for distributing information. The closest matching response is selected from the closest matching statement. By matching the input using WordNet, the response is taken from a known selection of statements. The objective was to implement a chatbot system online which helps users for accessing college websites, using AI tools exposing methods such as NLP. This allows users to interact with the chatbot by the use of natural language input and appropriate ML methods are used to train the chatbot for generating a response.

Human appearance is incorporated by numerous applications and intends to simulate human dialogue. In most cases, chatbot knowledge is stored in a human expert-created database.

In 2019 Manyu Dhyani and Rajiv Kuma [11] proposed a method for analyzing the deep learning computation performance for an Assistant Conversational Agent (Chatbot). This method utilizes Tensorflow software library. The input sentence with large number of tokens (or sentences with more than 20–40 words) can be replied with more appropriate conversation by using the Bidirectional Recurrent Neural Networks (BRNN). The model is trained by using the dataset from Reddit. The English to English translation is performed by this model.

### III. PROPOSED SYSTEM

We have developed a user-friendly chatbot application that serves a dual purpose: it answers general inquiries as well as college-related questions. With our app, students can conveniently retrieve their academic details without having to navigate through the college website. By logging in with their email ID and password, students gain access to personalized information. When a student seeks their academic details, our app retrieves their unique admission number from our database using their email ID. Subsequently, tailored queries are generated specifically for that individual. All the relevant data is efficiently stored in a MySQL database. To enhance the user experience, we employ the Rasa framework [5] for generating accurate responses to academic-related queries. By utilizing tokenization, we break down sentences into meaningful units, allowing us to generate contextually appropriate responses based on the keywords present in the queries.

By incorporating AI, we have made our chatbot much more user-friendly and capable of understanding human language. Instead of relying solely on SQL queries, which could be challenging to handle when questions were phrased in a tricky or unconventional manner, our chatbot now possesses the ability to comprehend various styles of questioning. This enhancement has resulted in more interactive and user-friendly conversations, as the chatbot can provide accurate answers even when questions are presented in different styles.

### IV. DESIGN OF INTRABOT

The user interface of IntraBot is designed using Figma, and it is implemented using Java in Android Studio. To access the application, users can log in through the login page. Once logged in, users are presented with two options: they can either ask general questions or seek responses to academic-related queries. By selecting an option, users are directed to a page that includes a list of frequently asked questions. They can choose from this list or proceed by clicking "Continue" to enter the chat interface, where they can interact with IntraBot. Each query generates a response, which is displayed in a scrollable recycle view. The interface's top right corner has a logout button, and a button is also provided to switch between dark mode and light mode for personalized visual preferences.

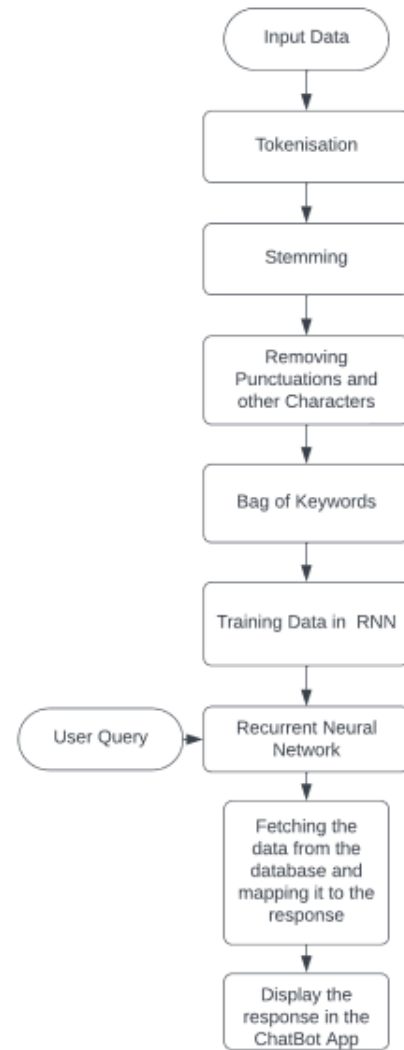


Fig. 1. Workflow diagram of the proposed scheme

Logging out will take the user back to the login page. Figure 2 shows the design of the IntraBot.

### V. IMPLEMENTATION PROCESS

#### A. User Interface and User Experience

The front-end development of the application is accomplished using the programming languages Java and Kotlin, utilizing essential dependencies such as Retrofit, Coroutines, Lifecycle, and Jetpack. This choice allows direct access to platform-specific features and APIs, empowering Android developers to fully leverage the capabilities of the Android SDK and seamlessly harness device-specific functionalities. Retrofit, a well-established and widely-used HTTP client library for Android and Java, is employed for efficient network request handling and API response management. By employing Retrofit, developers benefit from the ability to make type-safe HTTP requests, ensuring the validity of requests through robust compile-time type checking. Moreover, Retrofit

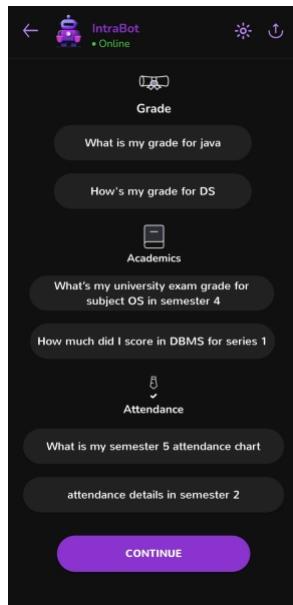


Fig. 2. User interface of IntraBot

offers automatic serialization and deserialization of JSON responses into Java/Kotlin objects, facilitated by popular JSON parsing libraries such as Gson or Moshi. On the backend, the application relies on the Golang programming language, which serves as a reliable foundation for authentication processes and the provision of highly secure networking and web services. Golang's inherent capabilities make it particularly suited for handling authentication requirements effectively. Furthermore, the application employs the MongoDB database, a renowned NoSQL database solution renowned for its flexibility and scalability in data management. MongoDB's document-oriented data model proves instrumental in accommodating evolving data schemas and seamlessly adapting to changing application needs, making it a fitting choice for storing and managing user details.

### B. Framework

Rasa is an open-source platform for creating AI apps that can have conversations. It offers a collection of tools and libraries that aid programmers in building chatbots and virtual assistants with natural language comprehension and dialogue management capabilities. Rasa enables you to create complex conversational bots that can comprehend user inputs, carry on relevant discussions, and deliver insightful commentary.

### C. Algorithm

**Rasa Core** - The core algorithm used by RASA is Rasa Core which is responsible for managing the dialogue flow of the bot and deciding the next action of the bot based on the current message. The algorithm uses the approach of Reinforced Learning from Natural Language Interaction (RLNLI) for training dialogue policies.

**Natural Language Processing (NLP)** - It analyses data from oral or written user inputs and enables human-machine

interaction without requiring users to learn Kotlin or any other programming language. The framework takes advantage of a computer system's natural language understanding (NLU), which enables it to extract relevant information from text or speech inputs and infer meaning. Contextual understanding, entity extraction, and intent recognition all use NLU. The retrieved entity is mapped into the user's intent, which includes their inquiries. The framework then returns the response, which contains the data that was retrieved from the database and is displayed by the response format, following the execution of a SQL query based on the entity.

### D. Neural Network

**Recurrent Neural Network (RNN)** - The IntraBot uses RNN which helps in intent recognition. Once the Natural Language understanding is done the keywords will be extracted from the text and given to the network which will then use it to select the intent and a SQL query will be applied to retrieve the value from the database which is then mapped into the response and then given back to the app. The database has almost 1085 values as input and the accurate response will be retrieved. The other machine learning techniques used are conditional random fields (CRFs) for entity extraction and support vector machines (SVMs) for intent classification.

### E. Dataset

The IntraBot dataset is stored in YAML (Yet Another Markup Language), a human-readable serial data format. The set of data represented by the yaml file consists of intents, which represent the user's goals or intentions while interacting with the chatbot. Each goal is given a unique name, such as 'points', 'participation', 'grade' or 'semmarks'.

The dataset uses the "examples" tag to capture the different questions or queries that users might ask about each intent. This identifier contains several examples of user requests related to a similar purpose. These examples serve as training data for the chat so that it can accurately understand and classify user input. The answers given by the chat are stored in the "in response" tag. This tag uses the "utterance" tag to specify a response that matches a specific intent. The "Utter" tag contains the predefined response text that the chat generates when it encounters the associated intent.

The dataset structure is described in Fig. 3 and Fig. 4 respectively

```
- intent: cgpa_year
  example: |
    - what is my year [1](year) cgpa
    - [2nd](year) year cgpa
    - year [3](year) cgpa
    - what is my cgpa in [first](year) year
    - [first](year) cgpa
```

Fig. 3. Intents for the query

By using the YAML format to store the dataset, the chatbot system achieves a balance between human readability and machine interpretability. The YAML-based dataset enables clear

```

responses:
  utter_cgpa:
    - text: "Your cgpa is {cgpa}"

```

Fig. 4. Response for the query

organization and easy maintenance of intents and responses, which facilitates the development and training of an effective conversational agent.

#### F. Cloud Deployment

The strategic deployment of the AI chatbot within the DigitalOcean cloud environment, utilizing Docker and NG-IX, enhances its adaptability and global accessibility. This paper outlines the systematic implementation of the chatbot, ensuring seamless performance and scalability on the selected cloud platform. Notably, the architecture demonstrates robust capability in handling concurrent users without compromising chatbot responsiveness.

In-depth testing has been conducted, specifically scrutinizing user-specific queries, with the chatbot consistently delivering accurate results. The meticulous evaluation yielded exemplary outcomes, affirming the efficacy of the deployed solution. Furthermore, the reliability of the chatbot application is underscored by the DigitalOcean platform's continuous availability, ensuring uninterrupted service delivery.

#### G. Future Developments

The strategic integration with the Google Cloud Maps platform. This augmentation aims to imbue the chatbot with an advanced utility, enabling users to solicit real-time insights on diverse amenities, including hospitals, hotels, malls, metros, theaters, and tourist destinations.

The intricately orchestrated fusion of the chatbot and Google Cloud Maps redefines user interaction paradigms. Users can now seamlessly inquire about nearby services, with the chatbot dynamically fetching and presenting pertinent details within the application interface. Each data block encompasses comprehensive information, encompassing visual representation, nomenclature, proximity to the user's locale, operational hours, and, upon selection, initiates a streamlined redirection to the mapping functionality.

This pioneering endeavor not only amplifies user satisfaction but underscores the chatbot's adaptability to cutting-edge technological integrations. The symbiotic relationship with Google Cloud Maps establishes an innovative framework for real-time spatial engagement, embodying a substantial leap in the sophistication and utility of conversational AI systems.

## VI. RESULTS

| Training Details |               |                   |
|------------------|---------------|-------------------|
| Epoch No.        | Training Loss | Training Accuracy |
| Epoch 10         | 2.17          | 0.918             |
| Epoch 20         | 1.14          | 0.925             |
| Epoch 30         | 0.854         | 0.936             |
| Epoch 40         | 0.515         | 0.941             |
| Epoch 50         | 0.355         | 0.949             |
| Epoch 60         | 0.211         | 0.952             |
| Epoch 70         | 0.132         | 0.955             |
| Epoch 80         | 0.112         | 0.958             |
| Epoch 90         | 0.095         | 0.960             |
| Epoch 100        | 0.074         | 0.965             |

With an intent accuracy of 0.965 and an entity F1 score of 0.875 after 100 training epochs, the trained model shows encouraging results. The model's convergence may be seen by the training loss, which now stands at 0.074. These assessment metrics are accurate measures of how well the model performs in identifying named entities from user communications and correctly forecasting user intents.

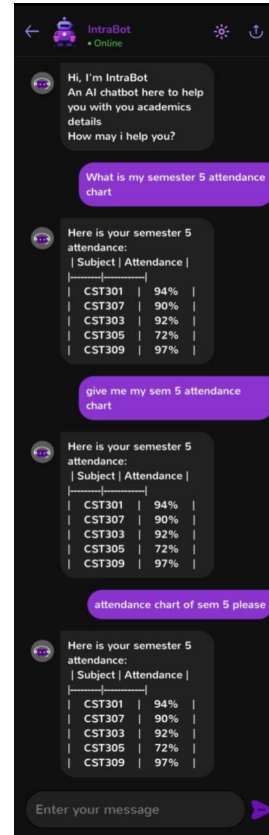


Fig. 5. Working of IntraBot

The IntraBot uses NLP along with NLU to extract the entity and map it to the corresponding intent which then returns the required response based on the query given by the user. Even

if the question is asked in a different way the bot can identify the response easily. Fig. 5 shows the response of the chatbot to the same question that was asked in three different ways.

## VII. CONCLUSION

Human language queries are easily understood by a chatbot and can automate efficient responses. The ability to process conversational texts and optimize time make chatbots constantly evolve. Analyzing and classifying the intent of the user's request in retrieving appropriate entities is the most crucial role of a chatbot. Another feature of the chatbot includes a 24x7 service and access to remote information. NLP and AI are used to develop IntraBot technology, which is an Android mobile application that uses Natural Language Processing Libraries and Machine Learning for having conversations with students. Through the IntraBot app, students get access to data in their college database, regarding essential information such as their attendance status, sessionals, university exam performances and more. The enhanced user experience of the app serves students to easily input the required data in a conversational chat model using human language. On identifying the keywords of the input text, time-efficient responses are generated. Frequently Asked Questions (FAQ) are also recommended to users to facilitate the search process. This chatbot development addresses the issues students face on browsing their data over the web. As a mobile application, one-time login surpasses the issue of traditional websites having to login repeatedly on each refresh or close. Most importantly, being a conversational model with fast data retrieval, the time consumption and difficulty of navigating through several web pages to access data is effectively addressed. As a result, the chatbot provides virtual assistance to students, enabling them to stay informed about general, college-related and academic-specific information aiming to optimize their effort and time.

## REFERENCES

- [1] R. Parkar, Y. Payare, K. Mithari, J. Nambiar and J. Gupta, "AI And Web-Based Interactive College Enquiry Chatbot," 2021 13th International Conference on Electronics, Computers and Artificial Intelligence (ECAI), Pitesti, Romania, 2021, pp. 1-5, doi: 10.1109/ECAI52376.2021.9515065.
- [2] Chiara Valentina Misischia, Flora Poecze, Christine Strauss, Chatbots in customer service: Their relevance and impact on service quality, *Procedia Computer Science*, Volume 201, 2022, Pages 421-428, ISSN 1877-0509,
- [3] B. R. Ranoliya, N. Raghuvanshi and S. Singh, "Chatbot for university related FAQs," International Conference on Advances in Computing, Communications and Informatics (ICACCI), Udupi, 2017, pp. 1525-1530.
- [4] N. P. Patel, D. R. Parikh, D. A. Patel and R. R. Patel, "AI and Web-Based Human-Like Interactive University Chatbot (UNIBOT)," 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2019, pp. 148-150, doi: 10.1109/ICECA.2019.8822176.
- [5] Manoj Joshi , Rakesh Kumar Sharma, 2020, An Analytical Study and Review of open Source Chatbot framework, RASA, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH AND TECHNOLOGY (IJERT) Volume 09, Issue 06 ,June 2020.
- [6] Delphin Lydia,J Sangeetha Priya, Dhivya Jai Sree G,Vidhya, Vijayameena S, Chatbot for College Management System, *International Journal for Research in Applied Science and Engineering Technology (IJRA)*, Volume 9, Issue 7, July 2021.
- [7] Hiremath, Guruswami, et al. "Chatbot for education system." *International Journal of Advance Research, Ideas and Innovations in Technology* 4.3 (2018): 37-43.
- [8] Thu, Cao Hoai, Huynh Cong Bang, and Linh Cao, Integrating ChatGPT into Online Education System in Vietnam: Opportunities and Challenges." (2023).
- [9] Kooli, C. Chatbots, "Education and Research: A Critical Examination of Ethical Implications and Solutions", *Sustainability*, 2023, 15, 5614. <https://doi.org/10.3390/su15075614>.
- [10] H. K. K., A. K. Palakurthi, V. Putnala and A. Kumar K., "Smart College Chatbot using ML and Python," 2020 International Conference on System, Computation, Automation and Networking (ICSCAN), Pondicherry, India, 2020, pp. 1-5, doi: 10.1109/ICSCAN49426.2020.9262426.
- [11] Dhyani, Manyu, and Rajiv Kumar. "An intelligent Chatbot using deep learning with Bidirectional RNN and attention model." *Materials today: proceedings* 34 (2021): 817-824.