

Intelligent Library Assistant (ILA) Using Artificial Intelligence and Natural Language Processing

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Abstract - With the outbreak of the recent pandemic coronavirus (formally known as COVID 19 or 2019nCov), we are embracing the "new normal" and using and relying more on virtual space than physical space ever before. In the library context, moving the user assistance program from physical to virtual causes problems with this migration. This project is based on a possible solution using a practical implementation of conversational AI. A "bot" that meets the needs of users 24 hours a day, 7 days a week without human intervention. A bot is a computer program that can simulate conversations and interact with humans (spoken, written, or both). It gets a set of pre-programmed commands and continues learning based on the input it receives. This project gives an overview of conversational AI, bots, and their multitasking capabilities, as well as a practical overview of their implementation. In addition, the project described the requirements of the current situation and the long-term benefits of bots in the library. Building customer support is one of the most important workflows for any business in the world. Technological growth is driving customer expectations, including the need for 24/7 service customer support, quick response, and answers to simple questions that require vast amounts of human resources and knowledge. Chatbots are solutions based on adapting AI technology to redesign customer service spaces. Imagine for a moment that chatbots help serve customers rather than humans providing customer support. In this project, a chatbot called "ILA" is built to explore library resources. This makes it easy to access the university library and find books available to students and faculty without having to go to the library in person. Students can explore library resources with the help of this chatbot. This allows students to connect to the library anytime, anywhere. The chatbot is built in Python and integrated with Flask, so users can access the chatbot from their mobile phones, laptops, and other handheld devices.

Key Words: Chatbot, Artificial intelligence, Neural network, Python, Flask.

1. INTRODUCTION

Libraries act with the social mindset of providing valuable information resources to those who cannot afford a huge collection of books for professional support. This is one of the university's most important assets. Therefore, the university is focused on maintaining and managing the details of library data as efficiently as possible. The value of a source can be judged not by money, but by its knowledge and usefulness. Therefore, institutions need to ensure that teachers and students receive the support they need to effectively use library resources. The main objectives of this project are, to explore the Library resources to the users by adapting an Artificial Intelligence Technology to easy communication between the user and the chatbot anytime and anywhere. In recent times, chatbots have reduced the need for human intervention. Artificial intelligence and machine learning have accelerated the evolution of chatbots to blur the line between human and bot styles of interaction. Chatbots are generally used in systems that involve chatting with users to either acquire information or provide the service as information to them. Although certain chatbots use natural language processing, many chatbots store their responses in a database and retrieve them when they receive input from the user. Advanced AI technology creates a chatbot self-learning system. Chatbots can learn to respond to each conversation without a script. Chatbot helps people by reducing the time spent navigating the web simply by providing the information they are looking for.

2. RELATED WORK

Nowadays, many applications require chatbot intervention rather than human interaction with the user requesting the service. For example, The university management system model chatbot is a simple system with pre-programmed data. The methods used are pattern matching, natural language processing, and data mining. The speaker or user input text is matched by the Chatbot with the template that exists in the database. Another web-based College Inquiry chatbot can mark a response from a chatbot as invalid if the response is not related to a query. In addition, some bots are trained with applications that respond to multiple analyzed requests from users. Education, business, and social media are some of the areas where chatbots

are used. It can be used as a learning tool. Currently, chatbot language support is limited. Therefore, there is plenty of room for future chatbots to remove such language barriers.

3. LITERATURE SURVEY

Artificial Intelligence Chatbots are followed in lots of sectors associated with consumer relationships. A studies crew via way of means of Liao et al. (2016) designed information enriched multimodal style chatbot that assists clients in looking for merchandise and matching extraordinary styles. They mentioned the machine and offered their strategies and stories whilst highlighting the demanding situations withinside the field. Ko & Lin (2018) have delivered a cardBot, a chatbot for enterprise card popularity and control in which an OCR module changed into applied. In the fitness sector, Madhu et al. (2017) proposed a concept for growing AI chatbots for scientific treatments. This unique form of chatbot assists human beings in taking important medicine and treatment. Park and Jeong (2019) have delivered a brand new conversation chatbot that interacts with the clients nearby. In keeping with their belief, it additionally has the capability for different fields. Villegas-Ch et al. (2020) mentioned the AI version chatbot responses to the desires of college students inside a clever campus. Artificial Intelligence (AI) can convert the jobs and capabilities of libraries to serve the brand new era of library customers. Gupta et al. (2020) articulated the software and capability effect of synthetic intelligence in instructional libraries. They diagnosed 4 domains: educational, informative, assistive, and social networking for synthetic intelligence applications. According to them, the libraries can undertake AI for numerous functions such as reference offerings, *Journal of Management Information and Decision Sciences* Volume 23, Special Issue, 2020 445 1532-5806-23-S1-213 Citation Information: Nawaz, N., & Saldeen, M. A. (2020). Artificial intelligence chatbots for library reference offerings. *Journal of Management Information and Decision Sciences*, 23(S1), 442-449. and highlighted that the very last intention of the chatbots is streamlining the capabilities of the reference offerings unit (Vincze, 2017). Mckie and Narayan (2019) in their exploratory paper emphasized the significance of attractive librarians in growing chatbots in conjunction with the collaboration of generation builders to fulfill the requirement of conducive gaining knowledge of the environment. Cox et al. (2019) defined Artificial Intelligence changed into taken into consideration to be one of the outstanding regions of attention that have to acquire interest from all sectors. Tubachi and Tubachi (2017) mentioned that the primary records associated with library offerings and centers can be added thru easy chat, prolonged chat, or video conferencing, email, FAQs, guided tours, and asking a librarian, internet forms, and chatbots. The chatbots can play a powerful position to attain the customers 24/7. As they mentioned that digital references are taken into consideration as an essential device in libraries. Chatbot integration inside a library internet site is straightforward and cost-powerful for libraries to make bigger their records offerings. Ali (2019) has shared the stories of growing "evidence of concept" and "AskSmooSmoo" chatbots and he mentioned 3 regions of concern: consumer experience, collaboration, and skills control for powerful offerings. Allison (2012) stated in his research paper that most user requests are directed or factual requests. McNeal and Newyear (2013) explained that libraries can build bots using the available coding options. AIML (Program Z or Program

O) and chat scripts are considered the best options for this purpose. "Virtual references" are considered an important tool for improving information services. Chatbots can be easily and inexpensively integrated into websites to improve information services. A systematic review of the literature review found that the number of research papers in this direction was very small in this study. Therefore, the purpose of this study was to carry out the study to fill the gap. In addition, the authors stated that few studies were conducted in connection with Bahrain. Therefore, researchers explored the benefits of AI chatbots in Bahrain's academic library reference services.

4. METHODOLOGY

4.1. NLP Techniques and Research

The three important NLP viewpoints concerning chatbots and other dialogue systems are:

1. Natural Language Understanding (NLU),
2. Natural Language Generation (NLG),
3. Dialogue Processing.

4.1.1. Natural Language Understanding (NLU)

NLU involves the process of extracting meanings from text inputs. In this direction, the basic design steps include:

- Syntactic Parsing - Determines the function of each word (part-of-speech), how the words interact, how they are grouped into phrases, and how they change words. Context-free 2 grammar (CFG) definition and parser implementation is the usual NLP techniques used in this step.
- Semantic Parsing - The position of a semantic parser is to extract the context-unbiased that means of a written sentence. The discriminative techniques together with support vector machines (SVM) and statistical techniques together with decision trees and classification and regression trees(CART) are used to discover the maximum in all likelihood parse tree that suits the sentence.
- Contextual Interpretation - Use discourse-level information to refine your semantic interpretation by removing the remaining ambiguities such as anaphora, pronouns, and abbreviations. The list of discourse entities (DEs) contains a set of constants that reference the object called in the previous statement. These objects can be implicitly referenced later.

4.1.2. Natural Language Generation (NLG)

NLG involves creating a chatbot response based on what is done in the NLU stage.

- Artificial Intelligence Markup Language (AIML) – an XML-compliant language for developing AI flows in dialog systems. Its purpose is to simplify the task of conversation modeling.

The important elements of AIML are:

- Categories - A basic knowledge unit consisting of patterns and templates.
- Recursive - Used to collate other categories recursively. This simplifies complex grammatical forms, expressed as a tag.
- Context – Category tags use context tags to refer to the user's previous input.
- Variables – Used to support the retrieval and setting of commonly used text with tags commonly used to store nouns.
- Pronoun Swapping – Used to replace pronouns such as "you" with "I" and "you" with "my" and so on.
- Document Scheduling / Response Generation – Breaks down high-level communication goals into a structured representation of atomic communication goals.
- Micro planning – A phase in which the number of phrases generated is determined to produce a more natural voice. Methods such as semantic grammar and inverse parsing are used to generate unnatural proto-phrases.
- Surface realization – The process of transforming the abstract structure obtained in the microplanning phase into a linguistic surface structure by adding function words, conjugating words, determining word order, and so on.
- Chat Script- Techniques to help if there is no match AIML. It focuses on the best syntax for creating a valid standard answer.
- Markov chain - It is more probabilistically applicable and is used to build more accurate answers as a result. The idea of Markov chains is that each letter or word in the same text record has a fixed probability of occurring.
- Language tricks include sentences, phrases, and paragraphs available in chatbots, making your knowledge base more diverse and compelling. The types of voice tricks are stereotyped responses, typos, simulated keystrokes, personal story models, and Non-Sequitur (no logical reasoning). Each of these language tricks is used to serve a specific purpose and provide an alternative answer to a question.
- Ontologies/Semantic networks – Consists of several relational and hierarchically related concepts. The purpose of using ontology in chatbots is to calculate relationships with synonyms, hyponyms, and other relationships that are natural language

term names. The relationships between these concepts can be represented in graphs that allow computers to search using specific inference rules.

4.1.3. Dialogue processing

The purpose is to build a man-machine dialog based on the switching process. In this process, information is sent from one participant (the user and another) to the dialog manager (DM). The dialog management process involves implementing a dialogue strategy to organize a sequence of system dialogs to achieve the common goals of users and chatbots. Chatbot user satisfaction is strongly influenced by the concept of degree of initiative. –

- System Led – A system-controlled initiative that asks users accurate questions and expects information or answers from them.
- User Led – User-led initiative. The system must provide information about the user's request without requesting details.
- Mixed-Initiative – An initiative in which both participants work together to achieve conversation goals. For example, chatbots share control between users and the system. With the relational database, chatbots can remember past conversations and build a knowledge base to make them more continuous and meaningful. You can use Structured Query Language (SQL) to generate queries and nest query blocks to store conversation history. This makes it especially easy to find word-phrase matches.

5. DESIGN AND IMPLEMENTATION

The Library Chatbot is based on intelligence that analyzes user requests and responds accordingly. This helps to make books available to students and faculties of different grades and faculties without having to go to the library. Flask is used as a platform/tool for building user queries and responses. It is integrated with the Flask-based web and the response is displayed in the GUI. In the dialog flow, the user query is analyzed and the chatbot gets the response and responds to the user. The system responds with an effective chat interface, which means that the real person is talking to the user. With the help of this bot, users can request information about library-related activities online. ILA helps users by saving time and providing data on library resources and responses to simple queries. Users do not have to go directly to the library to ensure book availability.

5.1. Agent and Intent creation

This module consists of 1) Agent creation & 2) Intent creation.

- Agent Creation: Agents are platform agnostic. Agent processes the request of the users which are in the form of natural language. It transforms a user's natural language request into an actionable query and is used to manage conversation flow in a specific way. It must be designed by an agent once and then it can be integrated with a variety of platforms using SDKs and integrations, or download files compatible with Facebook Messenger, Slack, etc.
- Intent creation: It epitomizes the mapping between what a user requests and what response should be taken. The main task is to train the phrase by adding user expressions using multiple informal contexts, short formats, and so on. Actions and parameters allow you to match entities by specifying parameter names, entities, prompts, and values. The text response is rendered by the bot as output that can be rendered in two formats. The default response of the dialog flow and the conversation is performed via the Flask GUI. The default reply is some kind of plain text.

5.2. Training the Bot and Database creation

In this module, you'll create an entity that makes it easy to reference your intent and train your bot to learn from that mistake. Each conversation initiated by a user not specified in the intent is saved in the User Speaks column of the training block. Select Click to Assign to approve the informal context used by the user. Finally, the informal context is approved and the bot is trained. To store all the details of a book in the university library, you need to create a database table with rows and columns. .CSV (Comma-separated Values) or a data.json files are used to store and retrieve information such as book id, book name, author name, subject name, book publishing, book position on the shelf, and make books available in the library.

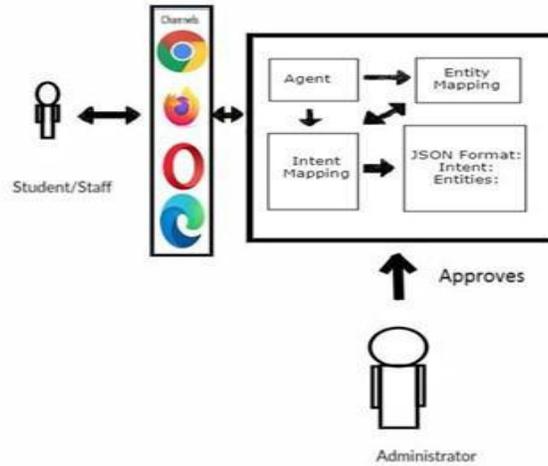


Fig No. 1. Architecture of the proposed system

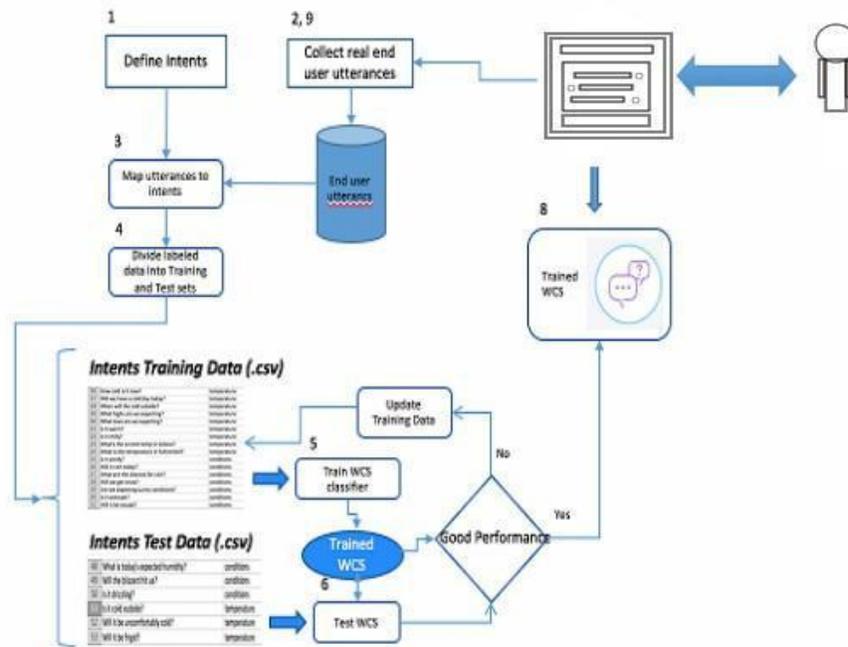


Fig No. 2. Design

The procedure that was implemented for the working of this chatbot system is as follows:

Step 1: Start.

Step 2: Train the phrases by adding the user expression in the intents e.g. For a user expression “List the subjects for CSE first-year” removal of stop words will be done by Entity mapping in the data.json file.

Step 3: Add the respective responses for the phrases trained during the intent creation.

Step 4: Get the user query (INPUT).

Step 5: In the query Remove stop words and fetch the keywords.

Step 6: Match the fetched keywords with the keywords in intent, if matched go to step 8, the bot will provide an appropriate response. A keyword matching algorithm will be applied to identify the matching. Otherwise, go to step 7.

Step 7: If no matched keyword then the new phrase is added to the training and mapped to a specific intent.

Step 8: Return the response as an output to the user.

Step 9: Exit.

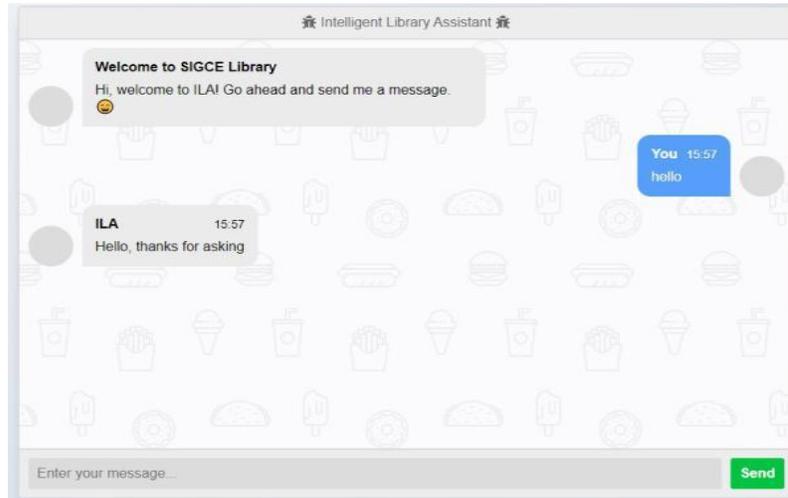


Fig No. 3. ILA GUI

5.3. Assessment Results

- **Scalability:** Multiple users can access the bot at the same time. So that many users can talk to chatbots, and it's scalable. Integration using a Flask-based GUI makes it very easy for the general public, including students and staff, to access the library. Bots can link to multiple social networking sites such as Twitter, Slack, popular websites, and university web portals.
- **Accessibility:** It will be much easier to integrate with the university web portal to make it more scalable for use in university bots. Each student can access using a username and password.

Usability: We have created a bot to get over 100 books from the CSE department. You can easily retrieve multiple department ledgers without making any changes to the process. Further progress will be made soon so that the library can exist without human resources, and simpler chatbots with more rule-based development will dominate. In conclusion, chatbots are emerging in marketing, large hospitals, and institutions, and may even replace the BPO industry in the future. The combination of chatbots and robots automates the process in different areas with few staff or specific areas with no employees. This also minimizes operating costs.

6. CONCLUSION

We have created a library chatbot for students, faculty, staff, and more. Library bots save time and replace human-human interactions with human-bot interactions. Chatbots are still in their infancy, but they are growing rapidly. The main goal of creating a library chatbot is to allow end-users to talk to the bot without considering task-oriented scenarios and to succeed in the project.

7. FUTURE SCOPE

There may come a time in the future, when we can reduce the amount of time we staff the reference desk, freeing librarians for more complex duties that require the skills that are unique to humans. It is doubtful that many reference librarians will cheer

that day; librarians like most people are reluctant to see technology take over even a small part of their jobs. Blacksmiths mocked the first automobiles, but we know how that ended. Should reference librarians be afraid of chatbots like assistants, etc? I doubt that it makes a difference; technology consumes jobs and the race is on to build the better bot.

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