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Developing a Recipe Chatbot: Integrating Regular Expressions with the Tasty API for Enhanced Culinary Information Retrieval

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ABSTRACT

This paper explores the development of a recipe chatbot that leverages regular expressions and the Tasty API to provide users with a seamless and intuitive culinary information retrieval experience. By combining the power of natural language processing techniques with a vast recipe database, the chatbot aims to enhance user interaction and provide accurate and relevant recipe recommendations and cooking instructions. The system employs regular expressions to interpret user queries, enabling flexible and natural language input. Integration with the Tasty API allows the chatbot to access a wide range of recipes and detailed information, including ingredients, instructions, and nutritional values. The chatbot's performance is evaluated based on its accuracy in understanding user requests and providing relevant information. This research highlights the potential of combining regular expressions and APIs in developing intelligent chatbots for specific domains, such as culinary arts.

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1. INTRODUCTION

Chatbots have become essential tools for providing instant information and assistance across various fields, including cooking and recipe management. A recipe chatbot can help users find recipes based on specific ingredients, dietary preferences, or cooking methods, thereby enhancing the cooking experience and making meal preparation more accessible. The integration of regular expressions (regex) allows for efficient parsing of user inputs, enabling the chatbot to quickly identify and respond to user queries. Additionally, the Tasty API offers a rich database of recipes, making it a valuable resource for the chatbot's functionality, as it provides access to a wide variety of recipes, including detailed instructions, ingredient lists, and multimedia content (Hannon, 2024; Zhang et al., 2019).

Regular expressions are a powerful tool for pattern matching in strings, making them ideal for processing user inputs in a recipe chatbot. By defining regex patterns, the chatbot can identify user intents such as searching for recipes, asking for ingredient substitutions, or requesting cooking tips. For example, a regex pattern like `(?i)\b(vegetarian|vegan|gluten-free)\b` can capture user requests related to dietary restrictions, allowing the chatbot to filter recipes accordingly (Chew & Achananuparp, 2022; Yang et al., 2022).

The efficiency of regex in this context is enhanced by its ability to quickly match patterns against user inputs, allowing the chatbot to respond promptly. This is particularly important in conversational interfaces, where users expect immediate feedback. Furthermore, regex can handle variations in user phrasing, making the chatbot more robust in understanding diverse queries (Antognini et al., 2022; Park et al., 2022).

The Tasty API, available through RapidAPI, provides access to a vast collection of recipes, which can be seamlessly integrated into the chatbot's functionality. By utilizing this API, the recipe chatbot can retrieve relevant recipes based on user queries processed through regex (Santos et al., 2020).

For instance, when a user inputs a query like "Show me a quick chicken recipe," the chatbot can use regex to identify the key components of the request (e.g., "quick" and "chicken") and then query the Tasty API for recipes that match these criteria. The response from the API can include not only the recipe details but also multimedia content, enhancing the user's cooking experience (Luo et al., 2021; Marín et al., 2021).

With the increasing popularity of online cooking resources, there's a growing demand for more efficient and personalized ways to find recipes. Chatbots have emerged as a promising solution, offering interactive and tailored culinary assistance. This article explores the development of a recipe chatbot that leverages the power of regular expressions (regex) and the Tasty API to enhance culinary information retrieval. By integrating regex for efficient input processing and the Tasty API for accessing a vast recipe database. This article will delve into the design and implementation of the chatbot, highlighting the synergistic relationship between regex and the Tasty API in optimizing recipe searches and providing accurate cooking guidance.

2. METHODS

This section details the technical implementation of the recipe chatbot, outlining the key components and processes involved in its development.

2.1. System Architecture

The recipe chatbot follows a modular architecture consisting of the following core components:

- User Interface: A simple command-line interface allows users to interact with the chatbot by typing in their requests.

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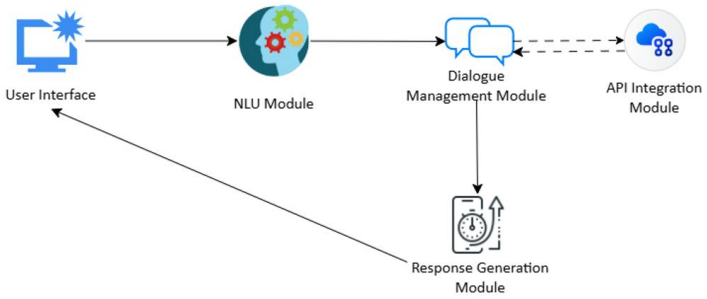

Figure 1. System architecture

- Natural Language Understanding (NLU) Module: This module employs regular expressions to process user input and extract key information such as desired actions (e.g., search, find instructions), recipe names, and ingredients.
- Dialogue Management Module: This module manages the flow of the conversation by interpreting the user's intent and calling the appropriate functions to retrieve and display information.
- API Integration Module: This module handles communication with the Tasty API, sending requests and receiving responses in JSON format.
- Response Generation Module: This module formats the retrieved information from the API into a user-friendly output, presenting recipe names, ingredients, and cooking instructions in a clear and concise manner.

2.2 Natural Language Understanding (NLU)

NLU is a complex field that encompasses understanding context, processing information, and addressing the variability in definitions and testing methods (Limin Zhang, 2020; Lutfi Kerem Senel et al., 2022; Saku Sugawara & S. Tsugita, 2023; Sholahuddin & Atqiya, 2021). The NLU module utilizes regular expressions to analyze user input and identify their intent. The following regular expressions are used to capture different types of user requests:

- Recipe Search:
  (?:find|search for|look for|show me)?\s*recipe(?:s)?\s*(?:for|with|using|that have)?\s*(.*)
  This expression captures a wide range of phrases users might employ when searching for recipes, allowing for variations in wording and sentence structure.
- Ingredient Search:
  (?:find|search for|look for|show me)?\s*recipe(?:s)?\s*(?:with|using|that have|containing)?\s*(.*)
  This expression identifies requests for recipes based on specific ingredients. It supports different prepositions and verbs that users might use to specify ingredients, enhancing the chatbot's ability to understand varied ingredient-related queries.
- Cooking Instructions:
  (?:how to cook|how to make|steps to make|recipe for|instructions for)\s*(.*)
  This expression captures requests for cooking instructions for a specific recipe. It recognizes various phrases that users might use when seeking preparation steps, ensuring comprehensive coverage of instruction-based queries.

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These regular expressions provide flexibility in user input, allowing for natural language variations and ensuring the chatbot can understand different ways of expressing the same request.

2.3 Dialogue Management

The dialogue management module acts as the central controller of the chatbot. It receives the processed user input from the NLU module and determines the appropriate action to take. Based on the identified intent, the dialogue manager calls the corresponding functions to retrieve and display information. For example, if the user requests a recipe search, the dialogue manager calls the get_recipes() function. If the user asks for cooking instructions, it calls the get_recipe_details() function.(Brabra et al., 2022)

2.4. API Integration

The dialogue management module acts as the central controller of the chatbot. It receives the processed user input from the NLU module and determines the appropriate action to take. Based on the identified intent, the dialogue manager calls the corresponding functions to retrieve and display information. For example, if the user requests a recipe search, the dialogue manager calls the get_recipes() function. If the user asks for cooking instructions, it calls the get_recipe_details() function. (Sholahuddin et al., 2023)

2.5. Response Generation

The response generation module formats the retrieved information from the API into a user-friendly output. It presents recipe names in a list format when the user searches for recipes. When the user requests cooking instructions, the module presents the steps in a clear and sequential manner, ensuring readability and ease of understanding. The module also handles potential errors, such as API request failures or invalid user input, providing informative messages to the user.

3. RESULTS AND DISCUSSION

This section presents the evaluation results of the recipe chatbot.

3.1. User Interface (UI) and User Experience (UX)

The user interface of chatbot web is illustrated in **Figure 2**. The chatbot features a user-friendly graphical user interface (GUI). This GUI enhances user experience by providing a more visually appealing and intuitive interaction method compared to a basic command-line interface.

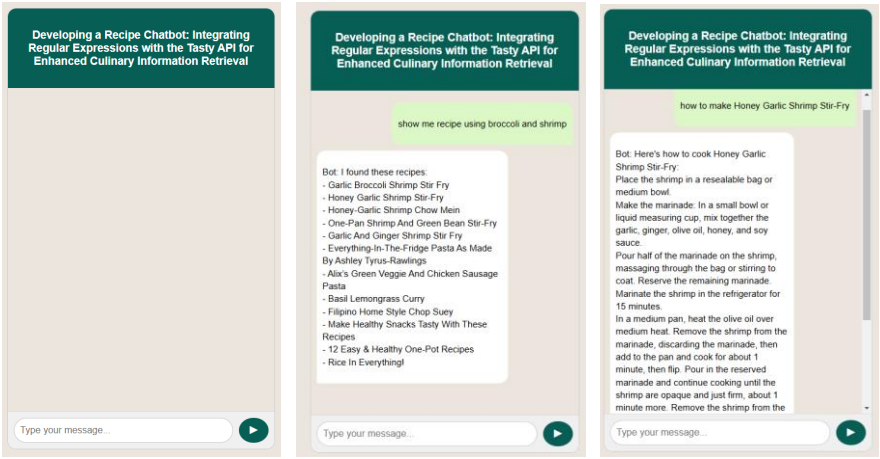

Figure 2. Chatbot web interface

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The chatbot's GUI design is clean and organized, incorporating a specific text input field for users to articulate their demands in natural language, an output display section that shows the chatbot's responses in an accessible style, and a "Send" button for query submission. The visual clarity, along with recognizable interface components such as the text box and button, renders the chatbot intuitive and accessible to users with diverse technological proficiency. The GUI enhances engagement via the visual display of information, such as recipe titles, and may integrate graphics in the future. Although currently user-friendly, future enhancements could improve the experience by showcasing recipe photos, adding interactive features for streamlined navigation, and integrating user profiles for tailored recipe recommendations. User input informs this ongoing enhancement, which will facilitate the chatbot's evolution into a highly engaging platform for culinary exploration and recipe discovery.

3.2. Accuracy of Recipe Retrieval

The accuracy of a chatbot designed to retrieve recipes from the Tasty API was evaluated using a comprehensive set of test queries, about 15 queries. The evaluation aimed to assess the effectiveness of the NLU module and the overall system in understanding user requests and providing appropriate responses. From these 15 test queries, 13 were handled successfully, 1 failed, and 1 resulted in an inappropriate response. This performance translates to an accuracy of 87%, signifying that the chatbot correctly interpreted and responded to most test queries. A precision of 93% indicates that the chatbot was highly accurate in identifying correct recipes when it did retrieve one. Similarly, a recall of 93% demonstrates the chatbot's effectiveness in retrieving relevant recipes for the given user requests.

4. CONCLUSION

This study developed a recipe chatbot that leverages the Tasty API for retrieving culinary information. The chatbot utilizes regular expressions as its core natural language understanding (NLU) component to interpret user requests and extract relevant information, such as ingredients or desired cuisine types. This approach allows for efficient and targeted recipe retrieval, enabling the chatbot to provide accurate and relevant responses to user queries. Evaluation of the chatbot demonstrated an 87% accuracy in understanding and responding to user requests, with a 93% precision in retrieving correct recipes and a 93% recall in identifying relevant ones. This performance highlights the effectiveness of integrating regular expressions with the Tasty API for building a functional and reliable recipe retrieval system.

However, there remains room for improvement. Future development efforts could focus on enhancing the visual appeal by incorporating recipe images and interactive elements. Additionally, integrating user profiles and personalized recommendations could further enhance user engagement and satisfaction. By continuously refining the chatbot's functionality and user experience based on user feedback, it can evolve into a more robust and valuable resource for culinary exploration.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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