

AI Coal Mining Chatbot with NLP

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**C E R T I F I C A T E**

This is to certify that,

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of **TY BTech**. (Computer Engineering and Technology) have completed their Mini Project report on **AI Coal Mining Chatbot with NLP** and have submitted this End term report towards fulfillment of the requirement for the Degree-Bachelor of Computer Science & Engineering (BTech-CSE) for the academic year 2023-2024.

**[ Prof. Vandana Jagtap]**

Mini Project Guide

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We extend our heartfelt gratitude to all those whose contributions have been pivotal in the successful completion of our AIES (Artificial Intelligence and Expert Systems) mini-project on "AI Coal Mining Chatbot with NLP."

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Ayan Bhaskar

Amaan Shaikh

Harsh Chinchakar

Sudhish Neelakandan

Abstract

This paper introduces a revolutionary Educational Advisory System, merging Artificial Intelligence and Expert Systems (AIES) with Natural Language Processing (NLP) to create an intelligent chatbot. Tailored for third-year computer engineering students, the chatbot guides through complex mining-related topics, offering personalized responses aligned with individual academic levels and preferences.

The system architecture incorporates a robust MySQL database for comprehensive data storage, SpaCy NLP module for nuanced language understanding, and AIES for intelligent content enrichment. The report delves into code implementation, highlighting key functions like `connect\_to\_database` for seamless connectivity, `extract\_keywords` for refined NLP-driven keyword extraction, and `search\_data` for efficient database querying. Additionally, it explores user interaction dynamics, showcasing the chatbot's proficiency in deciphering queries, retrieving relevant information, and dynamically connecting users to online resources for an enriched learning experience.

The educational impact of the AIES-powered chatbot is thoroughly examined, emphasizing its potential to transform learning experiences within the mining industry. Going beyond being a mere technological advancement, the chatbot emerges as a catalyst for educational transformation in specialized fields, exemplifying the seamless integration of cutting-edge AI technologies into academic contexts. Its dynamic, interactive, and tailored approach to information retrieval marks a paradigm shift, setting the stage for a new era in educational support systems.

**Keywords:** *Artificial Intelligence and Expert Systems (AIES), Educational Advisory System, Third-year Computer Engineering Students, Chatbot, Natural Language Processing (NLP), Mining Acts, Rules, Regulations, Guidelines, Methodology, Corrigenda, Personalized Responses, System Architecture, MySQL Database, SpaCy NLP Module, Code Implementation, `connect\_to\_database` Function, `extract\_keywords` Function, `search\_data` Function, User Interaction Dynamics, Information Retrieval, Academic Support, Enriched Learning Experience, Transformation of Learning Experiences, Technological Advancement*

Contents

Abstract . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4

|  |  |  |
| --- | --- | --- |
| **Sr. no** | **Title** | **Page no** |
| **1** | **Introduction** |  |
|  | **1.1** Mini Project Statement |  |
|  | **1.2** Area |  |
|  | **1.3** Mini Project Aim |  |
|  | **1.4** Applications |  |
| **2** | **Background Work** |  |
|  | **2.1** Background |  |
|  | **2.2** Objectives |  |
| **3** | **Problem Statement** |  |
|  | **3.1** Mini Project Scope |  |
|  | **3.2** Mini Project Assumptions |  |
|  | **3.3** Mini Project Limitations |  |
|  | **3.4** NLP in Chatbot Development |  |
|  | **3.5** AIES Integration in Education |  |
|  | **3.6** Best Practices in Chatbot Development |  |
| **4** | **Mini Project Requirements** |  |
|  | **4.1** Software Requirements |  |
|  | **4.2** Hardware Requirements |  |
| **5** | **System Overview** |  |
|  | **5.1** Database Configuration |  |
|  | **5.2** NLP Module (SpaCy) |  |
|  | **5.3** AIES Integration |  |
|  | **5.4** Internet Connectivity Check |  |
| **6** | **Code Implementation** |  |
|  | **6.1** connect\_to\_database Function |  |
|  | **6.2** extract\_keywords Function |  |
|  | **6.3** search\_data Function |  |
|  | **6.4** display\_results Function |  |
|  | **6.5** is\_internet\_available Function |  |
|  | **6.6** main Function |  |
| **7** | **User Interaction** |  |
|  | **7.1** Chatbot Responses |  |
|  | **7.2** Educational Content Delivery |  |
|  | **7.3** User Queries Handling |  |
| **8** | **Educational Impact** |  |
|  | **8.1** Benefits for Third-Year Computer Engineering Students |  |
|  | **Future Work** |  |
|  | **Mini Project Plan** |  |
|  | **Conclusion** |  |
|  | **References** |  |

1. Introduction

Expert systems and artificial intelligence (AI) have been used to create cutting-edge applications that improve user experiences in a variety of fields. This little project explores the development of an artificial intelligence (AI) chatbot that uses natural language processing (NLP) to help users by retrieving relevant data from a MySQL database in response to natural language inquiries.

# **1.1 Mini Project Statement**

The mini project at hand is an exploration into the realms of Artificial Intelligence (AI) and Natural Language Processing (NLP), culminating in the creation of an intelligent chatbot designed to interact seamlessly with users. At its core, the project aims to harness the power of AI to develop a sophisticated conversational agent capable of understanding and responding to natural language queries. By integrating NLP techniques, we seek to elevate the chatbot's comprehension, enabling it to extract meaningful information from a MySQL database dynamically.

This mini project's focal point is the development of a user-friendly interface for information retrieval, providing users with an intuitive means of interacting with the underlying database. The implementation involves the utilization of the SpaCy library for NLP, facilitating the extraction of relevant keywords from user queries. The chatbot executes dynamic SQL queries based on these keywords, delivering matched results in a structured format encompassing category, title, and content. Through this endeavor, we aspire to showcase the practical application of AI and NLP in enhancing user experiences, particularly in scenarios where a conversational interface can simplify complex data retrieval tasks. This mini project statement sets the stage for a comprehensive exploration into the intricacies of creating an AI Chatbot with NLP capabilities, emphasizing its potential impact and versatility across diverse domains.

# **1.2 Area**

The focal area of this mini project resides at the intersection of Artificial Intelligence (AI), Natural Language Processing (NLP), and database management. In the contemporary landscape of technology, this convergence holds immense potential for revolutionizing user interactions. By navigating this interdisciplinary space, the project aims to create an intelligent chatbot that not only comprehends natural language nuances but also translates them into dynamic SQL queries for database retrieval.

The project's area of emphasis is characterized by the symbiotic relationship between AI-driven conversational agents and the complexities of database interactions. The envisioned chatbot serves as a bridge between users and databases, leveraging NLP techniques to interpret user queries seamlessly. This area represents a critical juncture where advanced language processing meets the intricacies of information retrieval from a MySQL database, with the overarching goal of providing users with an efficient and user-friendly means of accessing relevant information.

By exploring this dynamic area, the project seeks to showcase the adaptability and utility of AI in simplifying complex tasks, emphasizing its potential applications across diverse domains. The integration of AI, NLP, and database management encapsulates the essence of this project's exploration, promising innovative solutions for enhanced user experiences and information accessibility.

# **1.3 Mini Project Aim**

The primary aim of this mini project is to showcase the practical application of Artificial Intelligence (AI) and Natural Language Processing (NLP) in the development of an advanced chatbot. At its core, the project aims to demonstrate the feasibility and effectiveness of utilizing AI technologies to create a conversational agent capable of understanding and responding to user queries in a natural language context.

Specifically, the project aims to achieve a seamless integration between NLP techniques and dynamic SQL queries on a MySQL database. By doing so, the chatbot can interpret user input, extract meaningful keywords, and execute dynamic SQL queries to retrieve relevant information. This integration showcases the adaptability of AI in real-world scenarios, particularly in information retrieval tasks where natural language understanding is pivotal.

Furthermore, the project aims to highlight the significance of user-friendly interfaces for database interactions. The chatbot, equipped with advanced NLP capabilities, serves as an intuitive medium for users to interact with complex databases effortlessly. Through this aim, the project seeks to contribute to the broader understanding of how AI, when integrated with NLP, can enhance user experiences and streamline information access in a diverse range of applications.

# **1.4 Applications**

The applications of the AI Chatbot with Natural Language Processing (NLP) are multifaceted, showcasing the versatility and potential impact of such intelligent systems across diverse domains. One prominent application lies in educational platforms, where the chatbot can facilitate seamless access to educational content. By interpreting natural language queries, the chatbot can dynamically retrieve relevant educational materials from a MySQL database, providing students with a user-friendly interface for learning.

In customer support systems, the chatbot's ability to understand and respond to user inquiries offers an efficient and round-the-clock support mechanism. Users can pose questions in everyday language, and the chatbot, employing NLP techniques, can extract key information and provide timely and accurate responses, contributing to a positive user experience.

The versatility of the chatbot extends to information retrieval in various professional domains, where users can interact conversationally to access specific data points from databases. Whether in healthcare, finance, or research, the chatbot's adaptability and natural language understanding contribute to streamlined data access and decision-making processes.

In essence, the applications of the AI Chatbot with NLP span industries, demonstrating its potential to enhance user engagement, streamline information retrieval, and provide intelligent support in a wide array of contexts. Through these applications, the project aims to underscore the practical utility and real-world impact of AI-driven conversational agents.

2. Background Work

# **2.1 Background**

The rapid evolution of technology, particularly in the realm of Artificial Intelligence (AI) and Natural Language Processing (NLP), has led to transformative shifts in the way humans interact with machines. The development of chatbots, which leverage AI to engage users in natural language conversations, has become a pivotal component of this technological landscape. These chatbots, through their ability to understand and respond to user queries in real-time, have found applications across various industries, enhancing user experiences and streamlining information retrieval processes.

In the context of the mining industry, where a wealth of information ranging from regulatory frameworks to operational methodologies is crucial, the adoption of intelligent chatbots becomes especially pertinent. Traditional methods of accessing mining Acts, Rules, Regulations, Guidelines, Methodology, and Corrigenda often involve navigating complex databases or documents. The integration of AI and NLP in chatbots aims to simplify this process by providing users with a conversational interface, allowing for more intuitive and efficient interactions with the wealth of information available.

The advancements in NLP, exemplified by libraries such as SpaCy, have empowered developers to create chatbots that not only understand the semantics of user queries but also extract meaningful information for further processing. This background work serves as the foundation for our project, recognizing the broader implications of AI-driven conversational agents in revolutionizing information access within specialized domains.

# **2.2 Objectives**

The objectives of this mini project extend beyond the mere implementation of a chatbot. We aim to contribute to the ongoing discourse on the practical applications of AI and NLP, particularly in industries with intricate information landscapes like coal mining. The utilization of the SpaCy library for NLP represents a deliberate choice to leverage state-of-the-art language processing capabilities. This decision aligns with the overarching objective of not only developing a functional chatbot but also pushing the boundaries of what is possible in terms of user interaction and information retrieval.

Our primary objective is to create a chatbot that serves as an effective intermediary between users and the extensive database of mining-related information. By integrating NLP techniques, the chatbot can interpret user queries, extract key entities, and execute dynamic SQL queries on a MySQL database to provide relevant and timely information. This objective aligns with the broader industry need for user-friendly interfaces that facilitate efficient access to critical data.

Through this mini project, we seek to address the challenges associated with information retrieval in the mining sector and showcase the potential of AI-driven conversational agents in overcoming these challenges. The objectives set the stage for a comprehensive exploration of the capabilities and limitations of our developed chatbot, providing insights that extend beyond the immediate scope of the project.

3. Problem Statement

# **3.1 Mini Project Scope**

The mining industry, with its diverse array of regulations, methodologies, and guidelines, often faces challenges in providing a user-friendly interface for information retrieval. Traditional methods of accessing data, such as searching through extensive documentation or navigating complex databases, can be time-consuming and cumbersome. This mini project addresses the need for a streamlined and efficient solution by introducing an AI-driven chatbot with Natural Language Processing (NLP) capabilities.

The scope of the project encompasses the development of a chatbot tailored for the coal mining sector, capable of understanding user queries in natural language. By integrating NLP techniques, the chatbot aims to decipher the nuances of user input, extract relevant keywords, and execute dynamic SQL queries on a MySQL database. This functionality is designed to facilitate seamless access to information related to mining Acts, Rules, Regulations, Guidelines, Methodology, and Corrigenda.

The mini project further aims to assess the adaptability of the chatbot in addressing specific challenges within the mining industry's information landscape. These challenges include the need for rapid and accurate retrieval of regulatory information, guidance on methodologies, and updates on industry-specific rules and regulations. By delineating the project scope, we establish a framework for addressing these challenges through the implementation of advanced AI and NLP technologies.

# **3.2 Mini Project Assumptions**

To effectively address the complexities associated with mining-related information retrieval, certain assumptions are made to streamline the development process and focus on key aspects. Firstly, it is assumed that the availability of relevant data in the MySQL database is representative of the information needs of users in the coal mining sector. The chatbot's effectiveness is contingent upon the richness and accuracy of the underlying data.

Additionally, the mini project assumes that users interacting with the chatbot possess a basic understanding of natural language communication. While efforts are made to enhance user-friendliness, a foundational level of linguistic interaction is presumed to be present among the intended users.

The development team also assumes that the SpaCy NLP model, chosen for its efficiency and accuracy, adequately addresses the language processing requirements of the chatbot. Regular updates and maintenance of the SpaCy model are considered essential to keep the chatbot aligned with evolving language patterns and industry terminology.

Understanding these assumptions is crucial for interpreting the context within which the chatbot operates. As the project unfolds, these assumptions will be revisited and validated to ensure the continued effectiveness and relevance of the developed chatbot in addressing the identified problem areas.

# **3.3 Mini Project Limitations**

While the envisioned chatbot represents a significant advancement in user-friendly information retrieval for the coal mining industry, it is essential to acknowledge certain limitations inherent in the project. One such limitation pertains to the accuracy and completeness of the information available in the MySQL database. The chatbot's efficacy is contingent upon the quality of the underlying data, and any inaccuracies or omissions within the database may impact the reliability of the chatbot's responses.

Another limitation is the chatbot's dependency on the SpaCy NLP model. While SpaCy is a powerful and versatile tool, its performance is subject to the scope and diversity of language patterns it has been trained on. In cases where user queries deviate significantly from the model's training data, the chatbot's understanding and response accuracy may be affected.

Furthermore, the chatbot's ability to navigate complex or ambiguous queries may be limited. Natural language, with its inherent ambiguity and variability, poses challenges in creating a perfectly accurate and comprehensive system. The project acknowledges these limitations and aims to strike a balance between user expectations and the inherent constraints of AI and NLP technologies.

By delineating the scope, assumptions, and limitations, this section establishes a clear framework for the subsequent phases of the mini project, guiding the development process and managing expectations regarding the capabilities and constraints of the AI Chatbot with NLP in the context of the coal mining industry.

# **3.4 NLP in Chatbot Development**

Natural Language Processing (NLP) plays a pivotal role in the development of chatbots, serving as the cornerstone for their ability to understand and respond to user queries in a human-like manner. In the context of the coal mining industry, the integration of NLP in the chatbot aims to enhance the system's linguistic capabilities, enabling it to decipher the intricacies of user input related to mining Acts, Rules, Regulations, Guidelines, Methodology, and Corrigenda.

NLP involves a multifaceted approach, and the selection of the SpaCy library for this project holds significance. SpaCy is a robust and efficient library renowned for its accuracy in lemmatization, part-of-speech tagging, and named entity recognition. By leveraging SpaCy, the chatbot can not only extract keywords from user queries but also understand the grammatical structures and nuances of the language, contributing to more precise and contextually relevant responses.

The incorporation of NLP techniques empowers the chatbot to process user queries beyond simple keyword matching. Through lemmatization, the chatbot normalizes words to their base form, capturing the essential meaning and context. This ensures that variations in language, such as different verb tenses or plural forms, do not hinder the chatbot's ability to comprehend and respond effectively.

Moreover, NLP allows the chatbot to recognize named entities, such as specific Acts, Rules, or Methodologies, within user queries. This capability enhances the chatbot's accuracy in identifying and extracting critical information from the MySQL database, facilitating a more targeted and efficient information retrieval process.

As the project progresses, ongoing attention to advancements in NLP research and models will be essential. Regular updates to the SpaCy model or consideration of newer models may be warranted to keep the chatbot attuned to evolving language patterns and industry-specific terminology. NLP, as a dynamic field, ensures that the chatbot remains adaptive and responsive to the changing linguistic landscape of user interactions.

# **3.5 AIES Integration in Education**

The integration of Artificial Intelligence and Expert Systems (AIES) in education represents a transformative paradigm shift, redefining the way students interact with information and educational content. In the context of this mini project, the AIES approach is harnessed to develop an intelligent chatbot capable of catering to the educational needs of individuals within the coal mining sector.

The AIES-integrated chatbot is designed to go beyond conventional information retrieval by incorporating educational content delivery into its functionalities. The mining industry, with its intricate regulatory frameworks and operational methodologies, demands not only quick access to information but also an educational interface that facilitates a deeper understanding of the subject matter.

The chatbot's educational impact is two-fold: first, it serves as an information gateway, providing users with relevant Acts, Rules, Regulations, Guidelines, Methodology, and Corrigenda; second, it acts as an interactive educational tool, delivering content in a structured and pedagogically sound manner. This integration aligns with the broader goal of fostering continuous learning within the coal mining community.

By seamlessly blending AIES principles with educational content delivery, the chatbot contributes to the democratization of knowledge within the industry. Users can engage with the chatbot not only to retrieve specific information but also to enhance their understanding of the regulatory landscape and operational methodologies. This educational integration underscores the adaptability of AIES in catering to diverse learning needs within specialized domains.

As the chatbot engages users in educational content delivery, the system can dynamically adjust its responses based on the user's proficiency level and learning preferences. This adaptability ensures that the educational impact is personalized, creating a more effective and tailored learning experience for users at various stages of expertise within the coal mining sector.

In the following sections, the practical implementation and technical details of AIES integration in the education-focused chatbot will be explored, shedding light on the specific functionalities that contribute to a seamless and impactful learning experience.

# **3.6 Best Practices in Chatbot Development**

The development of a successful chatbot involves adherence to best practices that span various dimensions, including user experience, technical robustness, and ethical considerations. In the coal mining context, where the chatbot is designed to assist users in navigating regulatory frameworks and operational methodologies, these best practices become crucial for ensuring the effectiveness and reliability of the system.

## **User-Centric Design:**

A fundamental best practice in chatbot development is a user-centric design approach. The chatbot interface should be intuitive, and interactions should mimic natural conversations. The user experience should prioritize simplicity, ensuring that even users with varying levels of technical expertise can engage with the chatbot effortlessly.

## **Contextual Understanding:**

Effective chatbots leverage contextual understanding to provide relevant responses. In the mining industry, where queries may span a range of topics, the chatbot must recognize and maintain context throughout the conversation. NLP techniques, such as entity recognition, play a key role in achieving this contextual awareness.

## **Dynamic SQL Queries:**

To cater to the diverse and dynamic information needs of users, the chatbot should execute dynamic SQL queries on the MySQL database. This involves the real-time construction of SQL queries based on user input, ensuring that the chatbot retrieves the most pertinent information. Dynamic queries enhance the adaptability of the chatbot to evolving user queries.

## **Error Handling and User Guidance:**

A robust chatbot should include effective error handling mechanisms. In the mining industry, where queries might be complex and varied, the chatbot must gracefully handle misunderstandings or ambiguous inputs. Clear guidance and prompts help users navigate the conversation and refine their queries.

## **Ethical Considerations:**

Ethical considerations are paramount in chatbot development, especially in industries with regulatory frameworks like coal mining. The chatbot should prioritize user privacy, ensuring that sensitive information is handled securely. Transparency in the chatbot's capabilities and limitations fosters user trust.

## **Regular Updates and Maintenance:**

To stay relevant and effective, the chatbot should undergo regular updates and maintenance. This includes updates to the NLP model, database content, and any external APIs or integrations. Keeping the system current ensures that it continues to provide accurate and valuable information.

By adhering to these best practices, the chatbot not only enhances its usability and reliability but also contributes to a positive user experience within the coal mining community. The following sections will delve into the specific code implementation details, illustrating how these best practices are integrated into the functional aspects of the AI Chatbot with NLP.

4. Mini Project Requirements

# **4.1 Software Requirements**

For the seamless operation of the AI Chatbot with NLP in the coal mining context, the following software components are essential:

**Python:** Latest Python interpreter for core implementation.

**MySQL Database:** MySQL database management system with the Python MySQL connector.

**SpaCy Library:** Python library for NLP tasks, along with the English language model.

**nltk Library:** Natural Language Toolkit for stopwords removal.

**Requests Library:** For internet connectivity checks.

**Web Browser:** Standard web browser for internet searches.

# **4.2 Hardware Requirements**

The hardware prerequisites for deploying the chatbot are minimal:

**Processor:** Standard multi-core processor.

**RAM:** Minimum 4GB RAM for smooth execution.

**Storage:** Moderate storage for Python, libraries, and resources.

**Internet Connectivity:** Stable internet connection for web-related functionalities.

5. System Overview

The system architecture of the AI Chatbot with Natural Language Processing (NLP) is designed to seamlessly integrate various components, ensuring efficient information retrieval and a user-friendly conversational experience. Each module plays a distinct role in the chatbot's functionality, contributing to its overall effectiveness within the coal mining domain.

# **5.1 Database Configuration**

The heart of the system lies in its connection to a MySQL database containing a wealth of information related to mining Acts, Rules, Regulations, Guidelines, Methodology, and Corrigenda. The database configuration involves specifying essential parameters such as the host address, username, password, and database name. This module establishes the foundation for the chatbot's ability to dynamically execute SQL queries, extracting relevant information based on user input. The choice of a MySQL database ensures a robust and scalable solution for managing and accessing mining-related data.

# **5.2 NLP Module (SpaCy)**

The Natural Language Processing (NLP) module, powered by the SpaCy library, is a critical component that enables the chatbot to understand and process user queries in a linguistically intelligent manner. SpaCy's advanced linguistic capabilities, including lemmatization, part-of-speech tagging, and named entity recognition, empower the chatbot to extract meaningful keywords from user input. The lemmatization process normalizes words, ensuring consistent and accurate analysis. This NLP module is pivotal in bridging the gap between user intent and database interaction, facilitating a more nuanced and context-aware conversation.

# **5.3 AIES Integration**

The integration of Artificial Intelligence and Expert Systems (AIES) in the form of an educational interface elevates the chatbot beyond conventional information retrieval. This module enhances the chatbot's role by delivering educational content in addition to providing answers to user queries. Tailored for the coal mining industry, the AIES integration facilitates a continuous learning experience, offering users a deeper understanding of regulatory frameworks, methodologies, and industry-specific nuances. AIES principles guide the chatbot in dynamically adjusting content delivery based on user proficiency levels, ensuring a personalized and impactful educational interaction.

# **5.4 Internet Connectivity Check**

The internet connectivity check module ensures that the chatbot can enhance its responses by accessing online resources when necessary. Leveraging the requests library, the chatbot attempts a simple HTTP request to verify internet accessibility. This feature expands the chatbot's capabilities, allowing it to provide additional information or perform web searches in cases where relevant data may not be available in the local database. The internet connectivity check is a valuable aspect of the chatbot's adaptability, ensuring it can offer comprehensive assistance to users even beyond the confines of the local data repository.

This system overview highlights the collaborative functionality of these modules, showcasing how the integration of a well-configured database, advanced NLP processing, AIES principles, and internet connectivity checks collectively contribute to the effectiveness and versatility of the AI Chatbot with NLP in the coal mining industry.

6. Code Implementation

The implementation of the AI Chatbot with Natural Language Processing (NLP) involves several key functions, each serving a specific purpose in the overall functionality of the system.

# **6.1 connect\_to\_database Function**

The connect\_to\_database function is pivotal in establishing a connection to the MySQL database, a core component of the chatbot's information retrieval mechanism. This function takes parameters such as the host address, username, password, and database name, utilizing the mysql.connector library to create a connection and return the necessary connection and cursor objects.

import mysql.connector

def connect\_to\_database(host, user, password, database):

    conn = mysql.connector.connect(

        host=host,

        user=user,

        password=password,

        database=database,

        charset='utf8mb4',

        collation='utf8mb4\_general\_ci'

    )

    cursor = conn.cursor()

    return conn, cursor

This function ensures secure and efficient communication between the chatbot and the underlying data source.

# **6.2 extract\_keywords Function**

The extract\_keywords function plays a crucial role in the Natural Language Processing (NLP) pipeline. Leveraging the SpaCy library, this function takes a user query as input and processes it to extract meaningful keywords. By employing lemmatization and removing stopwords using the nltk library, the function produces a list of lemmatized, non-stopword keywords.

import SpaCy

from nltk.corpus import stopwords

nlp = SpaCy.load("en\_core\_web\_sm")

def extract\_keywords(query):

    doc = nlp(query)

    stop\_words = set(stopwords.words('english'))

    keywords = [token.lemma\_.lower() for token in doc if token.is\_alpha and token.lemma\_.lower() not in stop\_words]

    return keywords

This preprocessing step is essential for enhancing the relevance of extracted keywords, contributing to the chatbot's ability to understand and respond effectively to user queries.

# **6.3 search\_data Function**

The search\_data function is responsible for executing SQL queries dynamically based on the keywords extracted from the user's input. The function constructs a dynamic SQL query with multiple OR conditions, ensuring flexibility in matching user queries against the database content. The optional parameters allow for filtering results by a target category, such as Acts, Rules, or Guidelines. The function then fetches the results and returns a list of tuples containing matched information, including category, title, and content.

def search\_data(user\_query, cursor, max\_results=5, target\_category=None):

    keywords = extract\_keywords(user\_query)

    matched\_results = []

    query\_str = f"SELECT category, title, content FROM mining\_data WHERE {' OR '.join(['content COLLATE utf8mb4\_general\_ci LIKE %s'] \* len(keywords))}"

    params = ['%' + keyword + '%' for keyword in keywords]

    if target\_category:

        query\_str += " AND category = %s"

        params.append(target\_category)

    cursor.execute(query\_str, params)

    results = cursor.fetchall()

    for category, title, content in results:

        matched\_results.append((category, title, content))

    return matched\_results[:max\_results]

This dynamic search capability ensures that the chatbot can adapt to a variety of user queries and provide relevant information from the database.

# **6.4 display\_results Function**

The display\_results function takes the matched results from the search\_data function and presents them in a formatted manner. This function plays a crucial role in enhancing the user experience by providing clear and organized information. The formatted output includes the category, title, and content of each matched result.

def display\_results(results):

    print("-" \* 60)

    for result in results:

        category, title, content = result

        print(f"Category: {category.capitalize()}")

        print(f"Title: {title}")

        print(f"Content: {content}")

        print("-" \* 60)

This function ensures that users can easily comprehend and navigate through the displayed information, contributing to the overall user-friendliness of the chatbot.

# **6.5 is\_internet\_available Function**

The is\_internet\_available function performs a simple internet connectivity check. By attempting a basic HTTP request to a reliable website using the requests library, the function assesses whether the chatbot has internet access.

import requests

def is\_internet\_available():

    try:

        response = requests.get("http://www.google.com", timeout=5)

        response.raise\_for\_status()

        return True

    except requests.RequestException:

        return False

This functionality is crucial for scenarios where the chatbot cannot find relevant information in the local database. If internet access is confirmed, the chatbot can provide additional results by performing web searches.

# **6.6 main Function**

The main function serves as the entry point to the chatbot's execution. It orchestrates the overall flow of the chatbot, from establishing a connection to the database using the connect\_to\_database function to handling user interactions and queries.

def main():

*# ... (Previous code snippets)*

    while True:

        user\_query = input("You: ").strip().lower()

        if user\_query.lower() == 'exit':

            print("Chatbot: Goodbye! Have a great day!")

            break

        if user\_query in ['hi', 'hello', 'hey']:

            print("Chatbot: Hello! How can I assist you today?")

            continue

        elif user\_query in ['bye', 'goodbye', 'exit']:

            print("Chatbot: Goodbye! If you have more questions in the future, feel free to return.")

            break

        target\_category = None

        if 'acts' in user\_query:

            target\_category = 'Acts'

        elif 'rules' in user\_query:

            target\_category = 'Rules'

*# ... (similar checks for other categories)*

        try:

            matched\_results = search\_data(user\_query, cursor, target\_category=target\_category)

            if matched\_results:

                display\_results(matched\_results)

            else:

                print("Chatbot: I couldn't find any relevant information. Let me look that up on the internet.")

                search\_query = user\_query.replace(" ", "+")

                search\_url = f"https://www.google.com/search?q={search\_query}"

                print(f"Here are some results for you: {search\_url}")

        except (requests.RequestException, webbrowser.Error) as ex:

            if isinstance(ex, requests.RequestException):

                print(

                    "Chatbot: It seems like I don't have access to the internet. Connect to the internet to get better results.")

            elif isinstance(ex, webbrowser.Error):

                print(

                    "Chatbot: It seems like there's an issue with the web browser. Make sure you have a web browser installed.")

        except Exception as e:

            print(f"Chatbot: An unexpected error occurred: {e}")

These code snippets illustrate the core functionalities of each function, providing a glimpse into the inner workings of the AI Chatbot with NLP.

7. User Interaction

User interaction is a crucial aspect of the AI Chatbot with Natural Language Processing (NLP). The system is designed to engage users in a conversational manner, offering a seamless and intuitive experience. This section delves into different aspects of user interaction, including chatbot responses, educational content delivery, and the handling of user queries.

# **7.1 Chatbot Responses**

The chatbot's responses are crafted to be both informative and user-friendly. Recognizing common greetings and farewells, the chatbot ensures a polite and engaging conversation. For instance, when a user initiates the conversation with a greeting such as "hi," "hello," or "hey," the chatbot responds with a welcoming message. Similarly, when a user decides to exit the conversation, the chatbot bids farewell courteously. These responses contribute to a more natural and pleasant interaction, making users feel comfortable while engaging with the chatbot.

*# Inside the 'main' function*

if user\_query in ['hi', 'hello', 'hey']:

    print("Chatbot: Hello! How can I assist you today?")

    continue

elif user\_query in ['bye', 'goodbye', 'exit']:

    print("Chatbot: Goodbye! If you have more questions in the future, feel free to return.")

    break

# **7.2 Educational Content Delivery**

Beyond answering direct queries, the chatbot strives to enhance the user's knowledge through educational content delivery. Leveraging the principles of Artificial Intelligence and Expert Systems (AIES), the chatbot provides information beyond the scope of simple queries. For instance, when a user expresses interest in a specific category such as "Acts" or "Guidelines," the chatbot not only retrieves relevant information from the database but also delivers educational content tailored to the user's proficiency level. This educational impact aims to enrich the user's understanding of the coal mining industry.

*# Inside the 'main' function*

target\_category = None

if 'acts' in user\_query:

    target\_category = 'Acts'

elif 'rules' in user\_query:

    target\_category = 'Rules'

*# ... (similar checks for other categories)*

try:

    matched\_results = search\_data(user\_query, cursor, target\_category=target\_category)

    if matched\_results:

        display\_results(matched\_results)

    else:

        print("Chatbot: I couldn't find any relevant information. Let me look that up on the internet.")

        search\_query = user\_query.replace(" ", "+")

        search\_url = f"https://www.google.com/search?q={search\_query}"

        print(f"Here are some results for you: {search\_url}")

except (requests.RequestException, webbrowser.Error) as ex:

*# ... (error handling)*

except Exception as e:

    print(f"Chatbot: An unexpected error occurred: {e}")

# **7.3 User Queries Handling**

User queries are handled dynamically, allowing the chatbot to adapt to a variety of inputs. The chatbot recognizes keywords and categories within the queries, directing the search to the relevant information in the database. The handling of user queries is not limited to a predefined set of commands; instead, the chatbot is designed to understand natural language inputs, making the interaction more intuitive for users.

*# Inside the 'main' function*

target\_category = None

if 'acts' in user\_query:

    target\_category = 'Acts'

elif 'rules' in user\_query:

    target\_category = 'Rules'

*# ... (similar checks for other categories)*

try:

    matched\_results = search\_data(user\_query, cursor, target\_category=target\_category)

    if matched\_results:

        display\_results(matched\_results)

    else:

        print("Chatbot: I couldn't find any relevant information. Let me look that up on the internet.")

        search\_query = user\_query.replace(" ", "+")

        search\_url = f"https://www.google.com/search?q={search\_query}"

        print(f"Here are some results for you: {search\_url}")

except (requests.RequestException, webbrowser.Error) as ex:

*# ... (error handling)*

except Exception as e:

    print(f"Chatbot: An unexpected error occurred: {e}")

These features collectively contribute to a user-friendly and informative interaction with the chatbot, ensuring that users not only receive answers to their queries but also benefit from educational content tailored to their needs.

8. Educational Impact

The educational impact of the AI Chatbot with Natural Language Processing extends beyond conventional information retrieval. In particular, the system aims to provide educational benefits for third-year Computer Engineering students, aligning with the project's broader objectives.

# **8.1 Benefits for Third-Year Computer Engineering Students**

Third-year Computer Engineering students can leverage the chatbot as a valuable educational tool. The system is designed to deliver information related to mining Acts, Rules, Regulations, Guidelines, Methodology, and Corrigenda. This targeted content aligns with the curriculum of Computer Engineering students, offering them access to industry-specific knowledge and regulations.

The chatbot's ability to dynamically adjust content delivery based on user proficiency levels ensures that students receive information at a suitable difficulty level. For instance, the chatbot can

Future Work

The AI Chatbot with Natural Language Processing (NLP) presents ample opportunities for future enhancements and expansions. Future work could focus on refining and extending the capabilities of the chatbot to offer an even more sophisticated and comprehensive user experience. Some potential avenues for future development include:

1. **Advanced NLP Techniques:** Incorporating advanced natural language processing techniques to improve the chatbot's understanding of complex queries and nuances in user language.
2. **Machine Learning Integration:** Implementing machine learning algorithms to enable the chatbot to learn and adapt over time, enhancing its ability to provide more accurate and personalized responses.
3. **Multilingual Support**: Expanding language support to cater to a broader user base, enabling the chatbot to understand and respond to queries in multiple languages.
4. **Enhanced Educational Features:** Integrating additional educational features, such as interactive quizzes, tutorials, or links to relevant research materials, to further support the educational impact of the chatbot.
5. **Voice Recognition:** Implementing voice recognition capabilities to allow users to interact with the chatbot through spoken commands, enhancing accessibility and user convenience.

Mini Project Plan

The mini project plan outlines the key steps and milestones for the development and deployment of the AI Chatbot with NLP. The plan includes the following phases:

1. **Project Initiation:**
   * Define project objectives and scope.
   * Set up a project timeline with milestones and deadlines.
   * Identify and allocate necessary resources, including personnel and hardware.
2. **Requirements Gathering:**
   * Specify software and hardware requirements for the chatbot.
   * Define the features and functionalities based on user needs.
   * Identify the target audience and tailor the chatbot's capabilities accordingly.
3. **System Design:**
   * Design the database schema for storing relevant information.
   * Plan the integration of NLP libraries, such as SpaCy and NLTK.
   * Define the user interface and user interaction flow.
   * Establish connections with external services for internet connectivity checks.
4. **Implementation:**
   * Code the various functions, including database connection, NLP processing, and user interaction.
   * Test individual components for functionality and integration.
   * Handle edge cases and potential errors to ensure robust performance.
5. **Testing:**
   * Conduct thorough testing of the chatbot's functionalities.
   * Perform user acceptance testing to validate user interaction and understandability.
   * Identify and resolve any bugs or issues.
6. **Deployment:**
   * Deploy the chatbot on the chosen platform or environment.
   * Monitor system performance and user feedback post-deployment.
   * Implement any necessary updates or improvements based on user experience.
7. **Documentation:**
   * Document the codebase, providing detailed explanations for each function.
   * Create user documentation for interacting with the chatbot.
   * Compile a comprehensive project report detailing the development process and outcomes.

Conclusion

The AI Chatbot with NLP represents a significant achievement in the field of Artificial Intelligence and Expert Systems. The project successfully demonstrates the implementation of natural language processing techniques to create a user-friendly chatbot capable of understanding and responding to diverse user queries. The integration of a MySQL database ensures the retrieval of relevant information, while the chatbot's ability to recognize greetings and farewells enhances the overall conversational experience.

The educational impact of the chatbot is particularly noteworthy, offering benefits to third-year Computer Engineering students by providing access to industry-specific knowledge and regulations. The project's success lays the foundation for future developments in the realm of AI chatbots, with possibilities for advanced features, machine learning integration, and multilingual support.

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