

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Computer Science and Engineering



Vidyayāmṛuthamashnuthe

22CSE137 - Innovative Project Lab Report **on** **Mining Chatbot**

Submitted in partial fulfillment for the award of degree of
Bachelor of Engineering in
Computer Science and Engineering

Submitted

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



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CERTIFICATE

Certified that the IPL project entitled **Mining Chat Bot** carried out by **A R Muthudhanush(1BG22CS002)**, **Aman Fayazahmed Soudagar(1BG22CS014)** and **Aniketh G V(1BG22CS019)**, **Sumanth(11BN23CS408-T)** bonafide students of III Semester B.E., **B.N.M Institute of Technology**, an Autonomous Institution under Visvesvaraya Technological University, submitted in partial fulfillment for the Bachelor of Engineering in COMPUTER SCIENCE AND ENGINEERING, Belagavi during the year 2023-24. It is certified that all corrections and Suggestions indicated for Internal Assessment have been incorporated in the report. The project report has been approved as it satisfies the academic requirements in respect of Innovative project lab prescribed.

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ABSTRACT

The Mining Regulatory Chatbot (MRC) leverages AI and NLP to simplify access to mining industry laws, interpreting user queries and swiftly retrieving relevant legal data from a comprehensive knowledge base. Its advanced algorithms deliver contextually appropriate responses tailored to the nuances of mining regulations, facilitating informed decision-making on environmental compliance, safety standards, and licensing requirements. Continuously learning from user interactions and feedback, the MRC evolves over time to enhance accuracy and relevance, serving as a pioneering tool for navigating the complex regulatory environment of the mining sector, empowering stakeholders to comply with regulations and make informed decisions with ease.

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CHAPTER 1

INTRODUCTION

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INTRODUCTION

In today's fast-paced world, industries are constantly seeking innovative solutions to enhance efficiency and productivity. One such solution that has gained significant traction in recent years is the implementation of chatbots. A chatbot is a computer program that utilizes Artificial Intelligence (AI) and Natural Language Processing (NLP) to comprehend and respond to user inquiries, simulating human conversation.

In the realm of mining industries, where adherence to various Acts, Rules, Regulations, DGMS Circulars, and other legal frameworks is paramount, the need for effective communication and accessibility of information is crucial. Among the plethora of regulations governing the mining sector in India, notable Acts and Rules include The Coal Mines Act, 1952, Indian Explosives Act, 1884, Colliery Control Order, 2000, Colliery Control Rules, 2004, The Coal Mines Regulations, 2017, and The Payment of Wages (Mines) Rules, 1956. Additionally, there are land-related laws such as CBA (Coal Bearing Areas) Act, LA (Land Acquisition) Act, and RandR (Resettlement and Rehabilitation) regulations that play a significant role in mining operations.

Recognizing the complexity of navigating through these legal frameworks and the importance of providing stakeholders and customers with prompt and accurate information, there arises a need for a comprehensive solution. Hence, the proposal to develop a chatbot equipped to address queries related to Acts, Rules, Circulars, and other pertinent information concerning the mining industry.

The envisioned chatbot aims to serve as a 24/7 virtual assistant, offering stakeholders and customers instant access to information and guidance regarding regulatory compliance, procedural inquiries, and other relevant topics. By leveraging AI and NLP technologies, the chatbot can interpret natural language queries, retrieve relevant information from databases, and provide tailored responses in real-time.

Moreover, beyond addressing queries pertaining to Acts and Regulations, the chatbot can also incorporate functionalities related to land-related laws, such as CBA, LA, and RandR, thus offering a robust Management Information System (MIS) for comprehensive support.

In essence, the deployment of a mining industry-focused chatbot represents a forward-thinking approach towards streamlining communication, enhancing accessibility, and promoting compliance within the sector. By harnessing the power of AI and NLP, stakeholders and customers can benefit from a user-friendly, efficient, and reliable information interface, ultimately contributing to improved operational efficiency and regulatory adherence in the mining industry.

1.1 MOTIVATION

Building a chatbot to assist stakeholders and customers in the mining industry is a commendable initiative with several potential benefits:

1. Accessibility:

Providing a chatbot that operates 24/7 ensures that stakeholders and customers can access information and get their queries addressed at any time, regardless of geographical location or time zone differences.

2. Efficiency:

Automating responses to common queries regarding Acts, Rules, Regulations, Circulars, and other relevant information can significantly reduce the time and effort required to provide assistance. This frees up human resources to focus on more complex or specialized tasks.

3. Consistency:

A chatbot ensures consistency in responses, avoiding discrepancies that may arise from human error or interpretation. This consistency helps in ensuring compliance with regulations and maintaining uniformity in information dissemination.

4. Scalability:

As the mining industry evolves and new regulations are introduced or amended, the chatbot can be easily updated to reflect these changes, ensuring that stakeholders and customers always have access to the latest information.

5. Cost-Effectiveness:

While developing and implementing a chatbot requires an initial investment, the long-term cost savings from reduced manpower requirements and improved efficiency can be significant.

6. Enhanced Customer Experience:

Providing stakeholders and customers with a readily available source of information through a chatbot can enhance their overall experience with the company or organization. Quick and accurate responses to queries demonstrate a commitment to customer service and satisfaction.

7. Data Insights:

Over time, the chatbot can gather valuable data on the types of queries received, common issues faced by stakeholders, and areas where additional clarification may be needed. This data can inform decision-making processes and help identify opportunities for process improvement.

Overall, a chatbot tailored to address queries related to Acts, Rules, Regulations, Circulars, and other relevant information in the mining industry can streamline operations, improve compliance, and enhance stakeholder satisfaction. It serves as a valuable tool in fostering transparency, efficiency, and accessibility within the industry.

1.2 PROBLEM STATEMENT

The project aims to develop a 24/7 chatbot using AI and NLP to provide guidance on mining regulations. It will cover Acts, Rules, Regulations, Circulars, and land-related laws, accessible through web, mobile, and messaging platforms. Deliverables include a functional chatbot with a comprehensive knowledge base and user-friendly interface. Success criteria include accuracy, promptness, and positive user feedback. Constraints include resource limitations and compliance with data privacy regulations. Overall, the project aims to enhance efficiency and compliance in the mining industry through accessible and reliable information dissemination via the chatbot.

1.3 OBJECTIVE

1. Develop an AI-powered Chatbot for the mining industry.
2. Utilize Natural Language Processing (NLP) for understanding and processing customer queries.
3. Provide instant and accurate responses to inquiries regarding:
 - Acts, Rules, Regulations, and Circulars applicable to mining industries (e.g., The Coal Mines Act, 1952; Indian Explosives Act, 1884).
 - Land-related laws such as CBA, LA, and RandR.
 - Management Information System queries.
4. Aim for 24/7 availability to cater to stakeholders and customers.
5. Enhance accessibility and efficiency in accessing information related to the mining sector.
6. Facilitate compliance with statutory requirements and regulations.
7. Support informed decision-making processes within the mining industry.
8. Promote effective management practices through accessible guidance and support.

1.4 SUMMARY

The proposed chatbot aims to provide stakeholders and customers in the mining industry with 24/7 access to information regarding various Acts, Rules, Regulations, DGMS Circulars, and land-related laws. These laws include:

1. The Coal Mines Act, 1952:

Governs various aspects of coal mining operations, including safety regulations, welfare provisions for workers, and environmental concerns.

2. Indian Explosives Act, 1884:

Deals with the regulation of explosives used in mining activities to ensure safety and security.

3. Colliery Control Order, 2000:

Specifies regulatory measures and controls for collieries (coal mines) to maintain safety standards and operational protocols.

4. Colliery Control Rules, 2004:

Provides detailed regulations and procedures for the management and operation of collieries, covering aspects such as licensing, safety, and environmental compliance.

5. The Coal Mines Regulations, 2017:

Encompasses comprehensive regulations for coal mines, covering various aspects including health, safety, welfare, and environmental management.

6. The Payment of Wages (Mines) Rules, 1956:

Governs the payment of wages to workers employed in mines, ensuring fair compensation and compliance with labor laws.

In addition to mining-specific regulations, the chatbot will also incorporate information related to land-related laws, such as the:

1. CBA (Coal Bearing Areas) Act:

Deals with the acquisition and management of land for coal mining purposes.

2. LA (Land Acquisition) Act:

Governs the process of acquiring land for public purposes, including mining projects.

3. RandR (Resettlement and Rehabilitation) Laws:

Address the resettlement and rehabilitation of communities affected by mining activities.

The chatbot will utilize Artificial Intelligence (AI) and Natural Language Processing (NLP) technologies to understand customer queries and provide relevant responses, imitating human conversation. By offering continuous access to accurate and up-to-date information on relevant laws and regulations, the chatbot aims to enhance stakeholder engagement, improve compliance, and streamline information dissemination within the mining industry.

CHAPTER 2
LITERATURE SURVEY

CHAPTER 2

LITERATURE SURVEY

1. The appropriation of conversational AI in the workplace: A taxonomy of AI chatbot users

Main Objective:

To understand how employees experience the use of AI chatbots in their day-to-day work.

Methodology:

- Single case study using a large international organization
- 46 semi-structured interviews, including 44 with unique participants
- Document reviews and go-along interviews with observations of chatbot interactions

Limitations:

- Single case study design limits generalizability.
- Interviews may be shorter and less spontaneous due to their virtual nature.

Advantages:

- Provides a parsimonious description of different types of AI chatbot users, which is useful for discussion, research, and pedagogy.
- Facilitates a more deeply nuanced understanding of the use and appropriation of AI chatbots by employees in an organizational setting.
- Can serve as a foundation for future research into the design, implementation, and use of AI chatbots in the workplace.
- Can help sociotechnical designers in enhancing the users' active involvement taking into account the AI chatbot features and organizational design and context that surrounds its implementation.

2. An Intelligent Behaviour Shown by Chatbot System

Objective:

To develop a domain-specific chatbot that provides information on university-related queries.

Methodology:

- Used ALICE chatbot system as a base.
- Created AIML files with questions and responses specific to the university domain.
- Implemented a pattern matching algorithm using depth-first search to find the best match for a given query.

Limitations:

- The system is limited to the knowledge base encoded in the AIML files.
- The pattern matching algorithm may not always find the most relevant response, especially for complex or ambiguous queries.

Advantages:

Provides quick and easy access to information on university-related queries.

- Can be used by students, faculty, and staff to get answers to their questions without having to search through multiple websites or documents.
- Can be integrated with other university systems, such as the student information system or library catalog, to provide a more comprehensive and personalized experience.
- Can be customized to fit the specific needs of the university, such as by adding institution-specific information or branding.
- Can be used to improve communication and engagement between the university and its stakeholders.

3. Review of integrated applications with AIML based chatbot

Objective:

The objective of the paper is to provide a review of integrated systems that utilize Artificial Intelligence Markup Language (AIML)-based chatbots.

Methodology:

The authors conduct a literature review of existing integrated systems that incorporate AIML chatbots. They examine the applications, functionalities, and advantages of these systems.

Limitations:

- The review is limited to integrated systems that use AIML-based chatbots.
- The authors do not provide an in-depth analysis of the specific algorithms or techniques used in these systems.
- The paper does not explore the ethical considerations or potential limitations associated with using chatbots.

Advantages:

- The paper provides a comprehensive overview of various integrated applications that leverage AIML chatbots.
- It highlights the benefits of using chatbots for tasks such as customer interaction, information retrieval, and humor generation.
- The review discusses the integration of chatbots with other technologies and software packages, making them more versatile and adaptable to different applications.

4. Chatbot for education system

Objective:

The objective of this paper is to develop an automated system that provides responses to user queries on behalf of a human in the education system.

Methodology:

The proposed system employs a combination of methods, including:

- **Machine learning:** To train the chatbot on a dataset of educational questions and responses.
- **Natural language processing (NLP):** To process and understand user queries in natural language.
- **Pattern matching:** To identify the intent of user queries by matching them against predefined patterns.
- **Data processing algorithms:** To extract relevant information from user queries and generate appropriate responses.

Limitations:

The authors acknowledge the following limitations of their system:

- The system relies on a finite dataset of questions and responses, which may not cover all possible user queries.
- The system's responses are limited by the knowledge and capabilities of the underlying machine learning model.
- The system may not be able to provide accurate or comprehensive responses to complex or nuanced queries.

Advantages

Despite these limitations, the authors highlight several advantages of their system:

- **Automated response generation:** The system eliminates the need for human intervention to answer user queries, saving time and resources.
- **Scalability:** The system is designed to handle a large volume of user queries simultaneously, ensuring efficient and timely responses.
- **User-friendly interface:** The system provides a user-friendly interface, making it easy for students and educators to interact with the chatbot.
- **High interactivity:** The system engages users in natural language conversations, simulating human-like interactions.

5. Programming challenges of Chatbot: Current and Future Prospective

Current Challenges:

- **Natural Language Processing (NLP):** Chatbots must process and understand human language, which presents challenges due to its complexity and ambiguity.
- **Machine Learning (ML):** Chatbots utilize ML to learn from user interactions and improve their responses, requiring extensive training data and algorithms that can handle different scenarios.
- **Intents and Entities:** Chatbots need to identify the user's intent (purpose) and extract relevant entities (keywords) from the input, which can be challenging in complex user utterances.
- **Conversation Flow Management:** Designing logical and engaging conversation flows is crucial for a user-friendly chatbot experience, but it requires careful coordination between different components.
- **User Feedback Integration:** Incorporating user feedback into the chatbot's training process helps improve its performance over time, but effectively collecting and processing feedback can be challenging.

Future Challenges:

- **Contextual Awareness:** Chatbots need to consider the context of user interactions to provide relevant and personalized responses, which requires advanced memory and processing capabilities.
- **Sentiment Analysis:** Understanding the user's sentiment (positive, negative, neutral) is important for empathetic and appropriate interactions.
- **Cross-Language Communication:** Enabling chatbots to communicate in multiple languages opens up new markets but requires sophisticated NLP capabilities and translation algorithms.
- **AI-Powered Chatbots:** Advances in AI (e.g., Language-
Large Models) promise chatbots with more human-like conversation skills and problem-solving capabilities.

- **Ethical Considerations:** Chatbots raise ethical concerns related to data privacy, bias in AI algorithms, and the potential for manipulation or misinformation.

Objective and Methodology:

- The objective is to provide an overview of the current and future programming challenges in chatbot development.
- The methodology involves reviewing existing literature, research papers, and industry practices related to chatbot technology.

Advantages of Chatbots:

- Improved customer service
- Automated tasks and processes
- Personalized user experiences
- Reduced costs
- 24/7 availability

Limitations of Chatbots:

- Limited understanding of complex queries
- Inability to handle sensitive or emotional situations
- Potential for bias or errors
- User fatigue due to repetitive interactions
- Security and privacy concerns

CHAPTER 3

SYSTEM REQUIREMENTS

CHAPTER 3

SYSTEM REQUIREMENTS

3.1 HARDWARE REQUIREMENTS

The hardware system requirements for building a chatbot capable of handling queries regarding mining acts, rules, circulars, and related laws will depend on various factors including the complexity of the NLP algorithms, the size of the knowledge base, anticipated user traffic, and the desired response time. Here's a general outline of the hardware specifications you might consider:

1. Processor (CPU):

- A multi-core processor (e.g., Intel Core i5 or higher, AMD Ryzen 5 or higher) to handle concurrent user queries efficiently.
- Consider CPUs with higher clock speeds and larger cache sizes for faster processing of NLP tasks.

2. Memory (RAM):

- Sufficient RAM to accommodate the chatbot application and its associated processes.
- Recommended minimum: 8GB RAM. For larger deployments or heavy workloads, consider 16GB or more.

3. Storage (HDD/SSD):

- SSD (Solid State Drive) storage is preferable for faster data access and improved performance.
- Estimate storage requirements based on the size of the knowledge base and any additional datasets used for training the NLP model.
- Ensure adequate storage space for logging, backups, and system updates.

4. Graphics Processing Unit (GPU) (Optional, for accelerated NLP tasks):

- If your NLP tasks involve intensive computations (e.g., deep learning-based models), consider using a GPU for acceleration.
- NVIDIA GPUs (e.g., GeForce GTX or RTX series, Quadro series) are commonly used for machine learning tasks.
- GPUs with CUDA support can accelerate popular deep learning frameworks like TensorFlow and PyTorch.

5. Networking:

- A stable internet connection with sufficient bandwidth to handle incoming user requests and access external data sources.
- Consider network redundancy and load balancing mechanisms for high availability and fault tolerance.

6. Operating System:

- Choose an operating system compatible with your development environment and deployment platform.
- Linux distributions (e.g., Ubuntu, CentOS) are commonly used for hosting chatbot applications due to their stability and performance benefits.

7. Server Infrastructure:

- Deploy the chatbot on a reliable server infrastructure capable of supporting 24/7 operation.
- Consider cloud-based solutions (e.g., AWS, Google Cloud Platform, Microsoft Azure) for scalability, flexibility, and ease of management.
- Configure auto-scaling policies to dynamically adjust server resources based on fluctuating demand.

8. Monitoring and Management Tools:

- Implement monitoring tools to track system performance, resource utilization, and user interactions.
- Use logging frameworks (e.g., ELK stack, Prometheus, Grafana) for collecting and analyzing chatbot metrics.
- Employ deployment and configuration management tools (e.g., Ansible, Docker, Kubernetes) for automated provisioning and scaling of infrastructure components.

By ensuring that your hardware infrastructure meets these requirements, you can build a reliable and scalable chatbot system capable of efficiently handling queries from stakeholders and customers in the mining industry.

3.2 SOFTWARE REQUIREMENTS

To build a chatbot capable of handling queries related to mining acts, rules, circulars, and land-related laws, you'll need a comprehensive software system that includes various components for natural language processing (NLP), data management, user interface, integration with external sources, and more. Here are the software system requirements:

1. Natural Language Processing (NLP) Engine:

- Choose an NLP framework/library such as spaCy, NLTK (Natural Language Toolkit), TensorFlow, or Hugging Face's Transformers.
- Train or fine-tune a pre-existing NLP model on a dataset containing examples of user queries and their corresponding intents/entities related to mining laws and regulations.
- Implement algorithms for intent classification, entity recognition, sentiment analysis, and dialogue management.

2. Knowledge Base Management:

- Develop a knowledge base management system to store and organize information on mining acts, rules, circulars, and land-related laws.
- Utilize a database management system (e.g., PostgreSQL, MongoDB) to efficiently manage and retrieve information from the knowledge base.
- Implement mechanisms for updating and maintaining the knowledge base regularly as new laws or regulations are introduced or amended.

3. Integration with External Data Sources:

- Establish connections with relevant external data sources such as government websites, legal databases, or internal document repositories.
- Implement APIs or web scraping techniques to retrieve real-time information or updates regarding mining laws and regulations.
- Develop mechanisms for data preprocessing and normalization to ensure consistency and accuracy of information retrieved from external sources.

4. User Interface (UI):

- Design an intuitive and user-friendly interface for the chatbot, allowing stakeholders and customers to interact with it easily.
- Implement features for text-based or voice-based input/output, depending on user preferences and platform capabilities.
- Incorporate features such as autocomplete suggestions, rich text formatting, and multimedia support to enhance the user experience.

5. Security and Compliance:

- Implement security measures to protect sensitive information and ensure compliance with data protection regulations (e.g., GDPR, HIPAA).
- Utilize encryption techniques to secure communication channels and data storage.
- Implement user authentication and access control mechanisms to restrict access to confidential information.

6. Scalability and Performance:

- Design the software system to be scalable and capable of handling a large volume of user queries concurrently.
- Implement load balancing mechanisms and horizontal scaling strategies to distribute incoming traffic across multiple servers or instances.
- Optimize algorithms and data structures to improve the performance and responsiveness of the chatbot.

7. Analytics and Reporting:

- Incorporate analytics tools to track user interactions, analyze usage patterns, and derive insights from chatbot data.
- Generate reports and visualizations to provide stakeholders with valuable information about user engagement, frequently asked questions, and areas for improvement.

8. Testing and Quality Assurance:

- Develop comprehensive test suites to validate the functionality, accuracy, and reliability of the chatbot across different scenarios and user inputs.
- Implement automated testing frameworks and continuous integration/continuous deployment (CI/CD) pipelines to streamline the testing and deployment process.
- Conduct usability testing and gather feedback from stakeholders to identify and address any usability issues or user experience challenges.

By meeting these software system requirements, you can develop a robust and reliable chatbot that effectively assists stakeholders and customers with queries related to mining laws, regulations, and land-related laws.

CHAPTER 4
SYSTEM DESIGN AND DEVELOPMENT

CHAPTER 4

SYSTEM DESIGN AND DEVELOPMENT

In the mining industry, efficiency and informed decision-making are crucial for success. To address these needs, MineMentor has developed a chatbot powered by AI. This chatbot, built using Python, Streamlit, and MySQL, leverages the Gemini Pro model from Google's GenerativeAI library to provide intelligent responses to user queries. In this article, we will explore the code structure and functionality of the MineMentor chatbot.

4.1 KEY CONCEPTS

Before diving into the code, let's understand a few key concepts:

1. Streamlit:

Streamlit is a Python library that allows developers to build interactive web applications with ease. It simplifies the process of creating and deploying data-driven applications.

2. MySQL:

MySQL is an open-source relational database management system. It is widely used for storing and retrieving structured data.

3. Gemini Pro Model:

The Gemini Pro model is a state-of-the-art generative model developed by Google's GenerativeAI. It is trained on a large corpus of text data and can generate human-like responses to user queries.

4.2 CODE STRUCTURE

The code provided consists of several sections that perform different tasks. Let's break down the code structure:

1. Importing Dependencies:

The code begins by importing the necessary libraries, including `dotenv`, `streamlit`, `os`, `pymysql`, and `google.generativeai`.

2. Loading Environment Variables:

The `load_dotenv()` function is used to load environment variables from a `.env` file. These variables contain sensitive information such as database credentials and API keys.

3. Database Connection Configuration:

The `db_config` dictionary stores the configuration details required to establish a connection to the MySQL database. The values for host, port, database, username, and password are retrieved from the environment variables.

4. Establishing a Database Connection:

The `pymysql.connect()` function is used to establish a connection to the MySQL database using the `db_config` dictionary.

5. Configuring Gemini API Key:

The `genai.configure()` function is used to configure the Gemini API key. The API key is retrieved from the environment variables.

6. Loading the Gemini Pro Model:

The `genai.GenerativeModel()` function is used to load the Gemini Pro model from the GenerativeAI library. This model will be used to generate responses to user queries.

7. Defining the `get_gemini_response()` Function:

This function takes a user question as input and uses the Gemini Pro model to generate a response. It returns the response generated by the model.

8. Setting Page Configuration:

The `st.set_page_config()` function is used to configure the Streamlit page. It sets the page title, icon, and layout.

9. Main Content:

The main content of the web application is displayed using Streamlit's `st.header()` and `st.subheader()` functions. These functions are used to display the welcome message and introduce the purpose of MineMentor.

10. User Input and Submission:

The user is prompted to enter a question using the `st.text_input()` function. The question is stored in the input variable. The `st.button()` function is used to create a submit button. When the button is clicked and the input is not empty, the `get_gemini_response()` function is called to generate a response.

11. Storing User Query and Response in the Database:

If a response is generated, the user query and response are stored in the MySQL database using the `INSERT INTO SQL` statement. This allows MineMentor to keep track of user interactions and improve its performance over time.

12. Storing User Query and Response in Session State:

The user query and response are also stored in the session state using the `st.session_state` object. This allows the chat history to be displayed on the web application.

13. Displaying Chat History:

The chat history is displayed using the `st.write()` function. The chat history is retrieved from the session state and displayed in the order of user queries and bot responses.

14. Closing the Database Connection:

Finally, the database connection is closed using the `connection.close()` statement.

The MineMentor chatbot is a powerful tool that leverages AI to enhance mining efficiency and decision-making. By utilizing the Gemini Pro model and a MySQL database, MineMentor can provide intelligent responses to user queries and store valuable user interactions. This code structure provides a foundation for building and deploying the MineMentor chatbot. With further development and customization, MineMentor has the potential to revolutionize the mining industry.

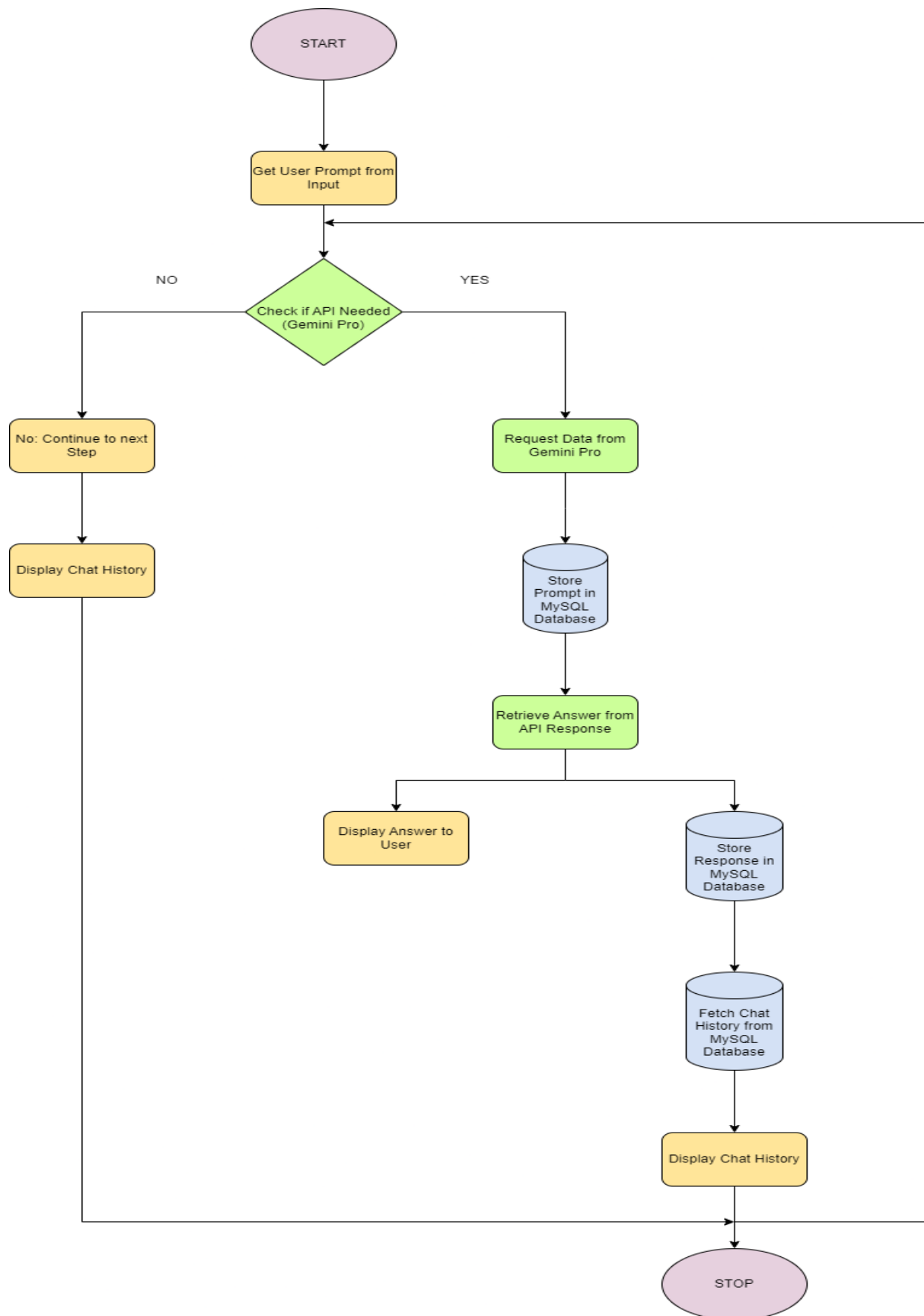


Figure 4.1 - Flowchart

CHAPTER 5

IMPLEMENTATION

CHAPTER 5

IMPLEMENTATION

1. Loading Environment Variables:

```
load_dotenv()  
print("DB_PORT:", os.getenv("port"))  
print("DB_HOST:", os.getenv("host"))
```

2. Establishing a Database Connection:

```
connection = pymysql.connect(**db_config)
```

3. Configuring Gemini API Key:

```
genai.configure(api_key=os.getenv("GOOGLE_API_KEY"))
```

4. Generating a Response:

```
response = get_gemini_response(input)
```

5. Storing User Query and Response in the Database:

```
with connection.cursor() as cursor:  
    for chunk in response:  
        user_query = input  
        bot_response = chunk.text  
        sql = "INSERT INTO response.user (user_prompt, bot_response)  
VALUES (%s, %s)"  
        cursor.execute(sql, (user_query, bot_response))  
    connection.commit()
```

CHAPTER 6

TESTING

CHAPTER 6

TESTING

1. MySQL Connection:

```
INSERT INTO response.user (user_prompt, bot_response) VALUES
    ('Hello', 'Hi there! How can I assist you today?'),
    ('What is your name?', 'I am a chatbot designed to help with
mining-related queries.'),
    ('Tell me about mining safety', 'Mining safety is crucial to
prevent accidents and ensure a secure working environment.');
```

```
SELECT * FROM response.user;
```

2. Connection String:

```
GOOGLE_API_KEY="AIzaSyC5_oz5NqZ1sB6HNMwr5rQohhSVYuruYL8"
```

```
# .streamlit/secrets.toml
```

```
#[connections.mysql]
dialect = "mysql"
host = "localhost"
port = 3306
database = "response"
username = "root"
password = "root"
```

CHAPTER 7

RESULTS

CHAPTER 7

RESULTS

Welcome to MineMentor

Transforming Mining with AI for Enhanced Efficiency and Informed Decision-Making

Input:

what are the process involved in Mining?

Ask the question

The Response is

1. **Exploration:** This is the first step in the mining process, and

it involves searching for and identifying areas that may contain valuable mineral deposits. Geologists and other experts use a variety of techniques, such as geological mapping, remote sensing, and geochemistry, to assess the potential of an area for mineral deposits.

2. **Prospecting:** Once an area has been identified as having potential for mineral deposits, further exploration is conducted to determine the extent and quality of the deposit. This may involve drilling boreholes, trenching, and collecting samples for

analysis.

3. **Feasibility Study:** Once a mineral deposit has been identified, a feasibility study is conducted to assess the economic viability of mining the deposit. This study considers factors such as the size and quality of the deposit, the cost of mining and processing the ore, and the potential market for the minerals.

4. **Exploration License:** If the feasibility study indicates that the deposit is economically viable, the mining company will apply for an exploration license from the government. This license gives the company the right to explore the area and conduct further drilling and sampling to determine the extent and quality of the deposit.

Figure 7.1 – Response Generation

The Chat History is

You: What is mining?

Bot: Mining is the process of extracting valuable minerals or other geological materials from the Earth,

Bot: usually from an ore body, vein, seam, reef, or placer deposit. The extracted materials may be mined for their economic value, such as for use in

Bot: jewelry, construction, machinery, or electronics. Mining is also used to extract fossil fuels, such as coal and petroleum, which are used to generate electricity and power vehicles.

Mining can be carried out in various ways, including:

- **Surface mining:** This involves removing the soil and rock covering an ore body to

Bot: expose it for extraction. This method is typically used for shallow deposits or when the ore is close to the surface.

- **Underground mining:** This involves digging tunnels, shafts, and adits into the Earth to reach the ore body. This method is used for deeper deposits or when the ore is not accessible from the surface.

- **Open-pit mining:** This is a type of surface mining that involves creating a large pit in the Earth to expose the ore body. This method is typically used for large-scale operations or when the ore is close to the surface.

Figure 7.2 – Chat history

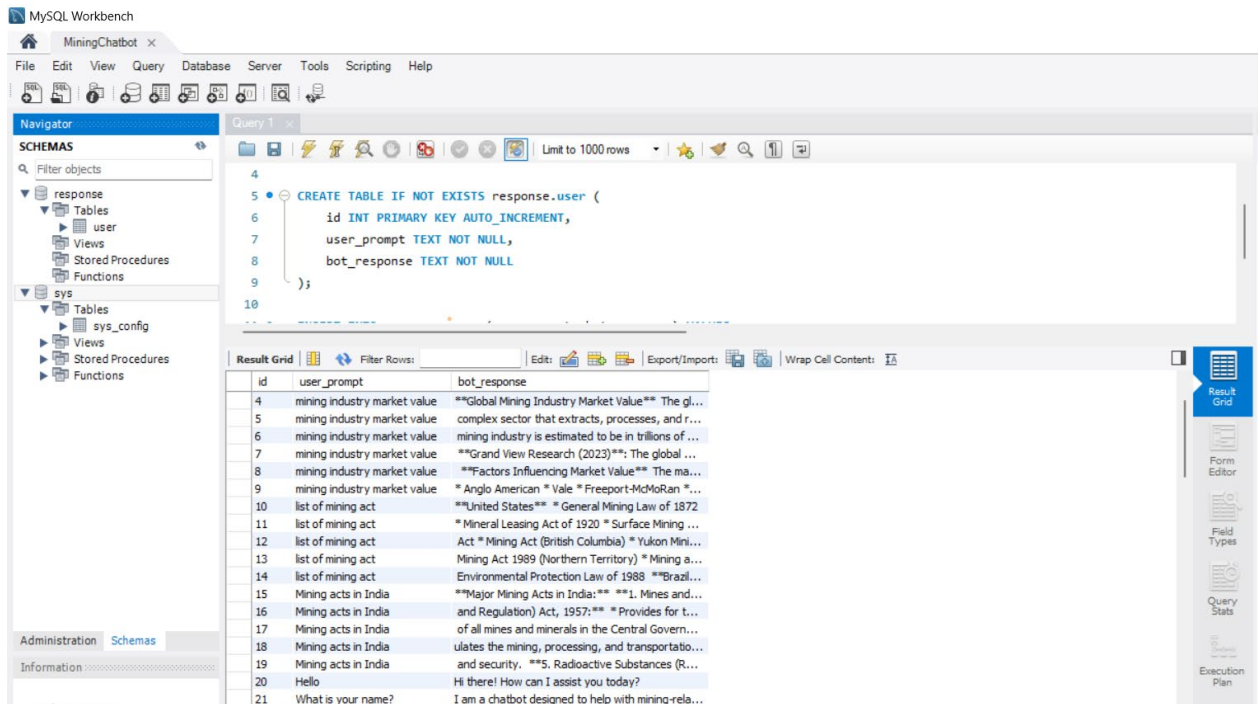


Figure 7.3 – MySQL Data Entries

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

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Building a chatbot for the mining industry to address queries related to Acts, Rules, and Regulations, as well as other pertinent information, holds significant potential for streamlining operations and improving stakeholder engagement. By leveraging Artificial Intelligence (AI) and Natural Language Processing (NLP) technologies, such a chatbot can effectively understand and respond to user inquiries, mimicking human conversation.

The identified Acts, Rules, and Regulations provide a solid framework for the mining industry, ensuring compliance and fostering a safe and efficient working environment. Integrating these legal aspects into the chatbot's knowledge base enables stakeholders and customers to access accurate information promptly, promoting transparency and reducing ambiguity.

FUTURE ENHANCEMENTS

1. Expanded Knowledge Base:

Continuously updating the chatbot's knowledge base with the latest Acts, Rules, and Regulations ensures relevance and accuracy over time. Incorporating additional legal frameworks or amendments enhances the chatbot's utility and usefulness.

2. Enhanced Natural Language Understanding:

Improving the chatbot's NLP capabilities allows it to comprehend complex queries more accurately. Fine-tuning language models and incorporating domain-specific terminology enhances user interaction and satisfaction.

3. Multi-channel Support:

Extending the chatbot's availability across various communication channels such as web chat, mobile apps, and voice assistants broadens its accessibility, catering to diverse user preferences and enhancing convenience.

4. Integration with Backend Systems:

Integrating the chatbot with backend systems and databases enables it to provide real-time information and personalized responses. This integration facilitates seamless access to data and enhances the overall user experience.

5. Advanced Analytics and Reporting:

Implementing analytics capabilities within the chatbot platform enables tracking user interactions, identifying trends, and gaining insights into user needs. Such data-driven insights inform decision-making and drive continuous improvement.

6. Compliance Monitoring and Alerts:

Developing features for monitoring compliance with regulatory requirements and issuing alerts for upcoming deadlines or changes ensures proactive risk management and regulatory adherence.

7. Language Support and Localization:

Supporting multiple languages and localizing content according to regional regulations and practices broadens the chatbot's reach and enhances its effectiveness in diverse contexts.

By incorporating these future enhancements, the proposed chatbot can evolve into a comprehensive and indispensable tool for stakeholders and customers in the mining industry, providing timely and accurate assistance while promoting compliance and efficiency.

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