Chatbot to respond to text queries pertaining to various Acts, Rules, and Regulations applicable to Mining industries

A PROJECT REPORT

Submitted by,

Mr. DARSHAN S M	**-20211COM0040**
Ms. T BHAVITHA REDDY	**-20211COM0021**
Mr. K P PAWAN	**-20211COM0067**
Mr. MANOHAR S V	**-20211COM0043**
Mr. CHETAN N	**-20211COM0057**

Under the guidance of,

Ms. AMIRTHA PREEYA V

Assistant Professor,
School of Computer Science & Engineering
Presidency University

in partial fulfilment for the award of the degree of

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CERTIFICATE

This is to certify that the Project report **"Chatbot to respond to text queries pertaining to various Acts, Rules, and Regulations applicable to Mining industries"** being submitted by "Darshan S M , T. Bhavitha Reddy , Manohar S V, K P PAWAN, Chetan N" bearing roll number(s) "20211COM0040, 20211COM0021, 20211COM0043, 20211COM0067, 20211COM0057" in partial fulfilment of the requirement for the award of the degree of Bachelor of Technology in Computer Engineering is a bonafide work carried out under my supervision.

Ms. AMIRTHA PREEYA V,
Assistant Professor
PSCS
Presidency University

Dr. GOPAL KRISHNA SHYAM
Professor & HoD
PSCS
Presidency University

Dr. MYDHILI K NAIR
Associate Dean
PSCS
Presidency University

Dr. SAMEERUDDIN KHAN
Pro Vice Chancellor Engineering
Dean -PSCS /PSIS
Presidency University

ii

PRESIDENCY UNIVERSITY

PRESIDENCY SCHOOL OF COMPUTER SCIENCE & ENGINEERING

DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **"Chatbot to respond to text queries pertaining to various Acts, Rules, and Regulations applicable to Mining industries"** in partial fulfilment for the award of Degree of **Bachelor of Technology** in **Computer Engineering**, is a record of our own investigations carried under the guidance of **Ms.Amirtha Preeya V, Assistant Professor, Presidency School of Computer Science & Engineering, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

NAME	ROLL NUMBER	SIGNATURE
Mr. Darshan S M	20211COM0040	
Ms. T Bhavitha Reddy	20211COM0021	
Mr. Manohar S V	20211COM0043	
Mr. Pawan K P	20211COM0067	
Mr. Chetan N	20211COM0057	

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ABSTRACT

Indian mining industry is governed by a range of Acts, Rules, Regulations, and directions, providing for safe, legal, and effective operation. Government publications published by government bodies like the Ministry of Coal and Directorate General of Mines Safety (DGMS) include a vast collection of statutory and regulatory publications.Some of the most prominent legislative provisions in the coal industry are the Coal Mines Act, 1952; the Indian Explosives Act, 1884; the Colliery Control Order, 2000; the Colliery Control Rules, 2004; and the Coal Mines Regulations, 2017. Apart from these, labor laws such as the Payment of Wages (Mines) Rules, 1956 and land laws such as the CBA (Coal Bearing Areas Act), LA (Land Acquisition Act), and R&R (Rehabilitation and Resettlement) policies add to the legislator complexity of the coal industry. It is difficult for the stakeholders such as mining companies, regulating authorities, legal advisors, and workers to trawl through this large amount of legal documents. For the convenience of accessing such information, a Smart Automation solution in the form of an AI and NLP-based chatbot is suggested. With the assistance of AI and NLP, the chatbot will understand natural language queries and make matching real-time replies. The chatbot will be trained on sequentially structured database of different Acts, DGMS circulars, Rules, and Committee of Inquiry (CoI) proceedings. Given the emphasis on identifying context and intent of questions, the chatbot will deliver context-based and correct answers. Continuous online availability 24x7, the chatbot will enable users to remotely scan legal and regulatory inputs at any point in time—facilitating decision-making, diminishing legal uncertainty, and enhancing augmented compliance in mining. With the addition of land acquisition and resettlement law in its kitty, the chatbot will answer a variety of questions and thus become an omnifunctional legal assistant. It also enables the creation of a composite Management Information System (MIS) for the benefit of assisting the digital thrust of the Ministry of Coal. In the Smart Automation theme, the project illustrates the real-world use of AI for stakeholder assistance and compliance. Legal information is easily accessible, compliance is facilitated, and governance and transparency of mining are ensured through the chatbot.

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Darshan S M(20211COM0040)
T. Bhavitha Reddy(20211COM0021)
Manohar S V(20211COM0043)
K P Pawan(20211COM0067)
Chetan N(20211COM0057)

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CHAPTER-1

INTRODUCTION

1.1 Overview

Historically, the mining sector has relied on manual processes, paperwork, and field knowledge to manage regulatory compliance, safety procedures, and operational workflows. With the appearance of digital technologies—conversational AI in this case—the time has come to create clever systems that have the ability to help users identify valuable information quickly and efficiently. The "Mining Industry Chatbot" is a web-based conversation artificial intelligence facility that is designed to assist users in recognizing acts, rules, and regulations related to mining. With its interactive interface, the chatbot supports natural language questioning and gives descriptive responses, and it is an excellent utility for miners, legal professionals, government officials, and researchers.

This project includes frontend development (HTML, CSS, JavaScript), backend interaction via OpenAI's GPT API, and user interface functionality like login/signup, speech recognition, file upload, and logging of message history. It is to provide easier access to regulating data and improved knowledge acquisition in the mining industry.

1.2 Relevance of AI to Mining Regulation

Mining law is broad, normally legally complex, and printed in a variety of documents. It is not easy to obtain the most recent information that is reliable, particularly in dangerous environments. Artificial intelligence chatbots have the potential to bridge the gap by knowing the questions, reading the pertinent documents, and returning concise answers. Furthermore, this approach eliminates the demand for human specialists and time wasted hunting bureaucratic or legal resources.

1.3 Why the Chatbot

- The reason for this chatbot is a stronger desire to:
- Enhance stakeholders' awareness of the legislation.
- Lower the price of acquiring compliance and legal counsel.
- Offer 24/7 availability of an electronic advisor with specialist expertise.
- Increase statutory information availability through use of cutting-edge AI technology.

1.4 Chatbot to respond to Text Queries related to Mining Industries

This project offers a simple but practical chatbot interface that allows users to interact with an AI-powered bot, providing an interactive conversation experience. The chatbot is triggered by a floating chat button at the screen's bottom right corner. On clicking, the chat button opens the chatbot interface, presenting a conversation window where users can type messages and receive responses. The chatbot utilizes OpenAI's GPT-3.5 model, in which the user's input is analyzed and answered right away using human responses in order to make the conversation seem natural. The chatbot contains a header with the name of the bot and close icon, a message area to display the conversation, and an input field in which users can write their messages. User messages are displayed on the right-hand side of the screen with a red background, and bot responses on the left-hand side with a darker background so that they can be easily distinguished. Integration with the OpenAI API is perhaps the most significant feature of this chatbot implementation. When a person sends a message, the message is passed on to the API so that the concerned message gets processed and the corresponding response is presented. So, during the interaction driven by the JavaScript, sending and receiving messages and showing the interface are done by a chatbot itself. The chatbot starts off hidden and can be activated by clicking the chat icon, and it can be turned off by clicking the close button found in the header. This ensures that the chatbot does not occupy unnecessary space on the screen but is readily available when needed. The interface is CSS-styled to provide a sharp, contemporary look. The floating chat icon is rendered red in color with a circular shape, which is extremely visible and easy to interact with. A subtle hover makes the icon larger and also changes its background color, providing a subtle visual cue. The chatbot window itself is dark-colored with rounded corners, providing a clean and professional appearance. In the chatbot, the user's messages appear in a red bubble to the right, and

the bot's messages appear in a dark gray bubble on the left, offering a clear visual differentiation between the two. This clear differentiation makes it easier to follow the conversation. In addition to this, the input field gives a user the capacity to type messages and, once a message has been typed, send it by either clicking on the send button or pressing the "Enter" key. Once the message has been sent, JavaScript ensures the response of the chatbot by putting the created reply in the chat window. In the case of an error while dealing with the API, a fall back message is shown to notify the user error. This chatbot interface can be used in a plethora of use cases, ranging from support for customers to resolving frequently asked questions or even engaging with users on a casual note. It is a flexible mechanism that can be designed and customized as per specific needs. By leveraging a powerful AI model like OpenAI's GPT-3.5, the chatbot is capable of generating intelligent, contextually relevant responses to a broad spectrum of user queries. It demonstrates how simple web technologies like HTML, CSS, and JavaScript can be combined with advanced AI to create a user-friendly and interactive chatbot. This project exemplifies just how simple it is to develop an effective AI-based chatbot which can be hosted on websites for a range uses.A combination of an intuitive interface and robust AI capabilities makes this chatbot perfect for enhancing user engagement and the user experience on any platform. The development of even more advanced and feature-rich chatbots, for example, is opened by integration with the OpenAI API. Moreover, with increased development of AI, this kind of integration will allow further potential development in a much wider direction: handling multi-step queries or querying databases for the purpose of sending personalized messages or multi-turn conversations. This implementation of the chatbot is a great place to begin for anyone wanting to delve into AI-driven interactions on their websites.

1.5 Overview of Legal Frameworks in the Mining Sector

Indian mining industry operates based on a unified set of Acts, Rules, and Regulations. They include Coal Mines Act, 1952, Indian Explosives Act, 1884, Colliery Control Order, 2000, Colliery Control Rules, 2004, and the Coal Mines Regulations, 2017. Stakeholders tend to experience them as lengthy and difficult to access. Chatbot can facilitate this by being a 24/7 online assistant, scanning information based on user queries. It closes the knowledge gap for engineers, lawyers, and workers to enhance compliance and reduce legal violations in the mining sector.

1.6 Importance of Domain-Specific Natural Language Processing (NLP)

The vocabulary of mining legislation is enriched with advanced terminologies, industry-based abbreviations, and cross-referencing provisions, which require NLP models to be trained on corpora of mining. The models are required to translate advanced legal terminology and provide context-relevant information to users. Multilingual understanding is equally crucial, especially in India where stakeholders prefer to work in local languages. The chatbot must also possess contextual relevance identification features, i.e., distinguishing rules pertaining to underground, open-cast, or mixed mining activities. In-house NLP models enhance the user intent comprehension of the chatbot as well as returning accurate answers based on the relevant acts, rules, or circulars, thereby improving user satisfaction and awareness towards compliance.

1.7 Classification and Organization of Legal Queries

Legal questions within this category need hierarchical classification to facilitate proper response generation. Legislation can be classified under themes like Safety, Wages, Environmental Compliance, and Handling of Explosives. All the regulatory documents like legislation, regulations, circulars, and FAQs must be kept in searchable form like JSON or XML. Legal questions typically belong to categories like direct legal searches, scenario-based questions, and procedural questions. Organizing data with metadata like document name, clause, relevant mining method, and effective date improves both chatbot performance and user experience through accuracy and relevance of responses.

1.8 Backend Intelligence for Predictive Query Routing

The backend smarts of the chatbot are powered by AI reasoning that directs queries to the most applicable legal sections or documents. Intent classification determines the general topic of the query—such as safety, licensing, or environmental norms—while entity recognition pulls out such key terms as "blasting", "inspection", or "pay slip". Query matching by cosine similarity or

transformer models such as BERT enables the system to provide proper results even with partial or uncertain queries, hence making the chatbot very effective.

1.9 Frontend Design's Role in Regulated Chatbots

Front-end is employed at the front end to enable interaction by users having varying levels of technical proficiency to interact with the chatbot. Features like multi-language input, auto-suggestion while searching, and voice-based query input make it more utilisable for miners, managers, and lawyers too. Rating mechanism feedback in returning answers makes the system as a whole better in the long term. In addition, authentication and access control disallow improper use, while real-time connectivity to government stores of data keeps the chatbot up to date. Legal correctness and responsiveness are obtained through user feedback loops, and update notifications, and actual legal push of updates in real time to account for new amendments.

1.10 Integration with Ministry and Regulatory Portals

Integration with ministry and regulatory portals such as the Ministry of Coal, DGMS, and state departments allows users to read official documents, download summaries, and generate reports. This provides greater transparency and allows policy makers to analyze trends. For deployment, cloud hosting, load balancing, and modular architecture allow scalability and flexibility across different mining domains and regions. The future development includes the design of AI-powered virtual legal consultants, IoT device integration to monitor compliance, and audit trail features for DGMS or internal safety audits. The development turns the chatbot advisory and compliance-oriented rather than reactive in nature in the mining sector.

CHAPTER-2

LITERATURE SURVEY

2.1 Introduction

Deploying Artificial Intelligence (AI) and Natural Language Processing (NLP) for constructing chatbot solutions has become widespread in most industries for information accessibility facilitation, as well as response automation. There are issues also for the stakeholders to be able to access and comprehend high volumes of Acts, Rules, DGMS Circulars, as well as court judgments in mining industry. It has been proved through studies that chatbots based on AI can address this issue by giving fast accurate responses to intricate legal questions. The literature develops the use of intelligent automation tools in automating regulatory compliance and enhancing stakeholders' engagement, thereby proving the feasibility of a 24/7 specialist chatbot for regulations of mining companies.

2.2 Related Work

In the past three years, Artificial Intelligence (AI) and Natural Language Processing (NLP) have aligned with a force of brute in law and rule landscapes. Chatbots have been effectively employed across several sectors such as banking, healthcare, and e-governance for real-time assistance, reducing human intervention, and increasing information availability. For example, Indian government and foreign nation government websites utilized chatbots for public scheme guidance, grievance redressal, and policy reporting. Similarly, sites like "Ask Sarkar" and government chatbots from states provided simple access to talk to the citizens through conversation accessibility of the law and service. In the legal community, AI chatbots like DoNotPay have been developed to assist users in their daily legal challenges and form completion. Such developments are an exhibition of amplified confidence in smart automation to penetrate deeper into complex information and respond promptly. Success stories in related industries need not be so strong in the legal chatbots of the mining industry but validate the feasibility of the use of a domain-specific chatbot interacting with mining law. Use of the technology by the Ministry of Coal would contribute substantially towards making the access of mining related Acts, regulations, DGMS circulars, and land-related legal provisions a simple affair and make regulatory compliance and transparency of operations simpler.

2.3 Existing Work

At present, Indian mining stakeholders use manual sources to obtain regulatory information mainly by surfing the official websites, using published rulebooks, and seeking help from legal advisors. The rules like the Coal Mines Act, 1952; Indian Explosives Act, 1884; Colliery Control Rules, 2004; and rules like these are frequently dispersed across different platforms, thereby creating bottlenecks in retrieval and interpretation. The Directorate General of Mines Safety (DGMS) releases circulars and safety alerts, but the latter are not fed into one consolidated digital format. Additionally, Proceedings of Committee of Inquiry (CoI) and land-oriented judicial documents like the Coal Bearing Areas (CBA) Act and Rehabilitation and Resettlement (R&R) guidelines are also released in an isolated manner, so that it becomes inconvenient for stakeholders to discover complete real-time answers. Whereas others of private companies utilize rudimentary knowledge management platforms, there isn't any present solution designed specifically to serve as a smart legal assistant for handling mining regulations. That absence represents a window to launch a central, AI-based chatbot with the ability to provide rapid, trustworthy, and legally sound replies to questions raised by users in a manner to drive greater compliance and decision-making speed throughout the industry.

2.4 Technologies Behind Chatbots:

These chatbots operate on some of the new, bleeding-edge technologies whose existence is supported by a bed of Natural Language Processing. NLP gives the chatbots the capacity to read, process, and respond to human language. NLP uses algorithms that are paired with ML in trying to deal with enormous amounts of text and learn from patterns in language. Apart from NLP, chatbot creation also includes machine learning and deep learning functions that improve the bot to respond with context-relevant answers as time goes on. The algorithms of machine learning are trained at first with giant data sets such that they comprehend user intent, sentiment analysis, and managing a conversation flow. Some chatbots, especially the advanced ones, employ deep learning strategies such as neural networks in order to enhance their capability to provide human-like responses. Transformer-based models, such as OpenAI’s GPT-3.5, are particularly notable for

their capability to generate highly coherent and contextually relevant dialogue, even for complex queries.

2.5 OpenAI and GPT Models:

The integration of OpenAI's GPT models, particularly GPT-3 and GPT-3.5, has revolutionized the chatbot landscape. These models are based on transformer architecture, a breakthrough in natural language processing. GPT-3, for instance, has 175 billion parameters, enabling it to understand and provide human-like responses for a broad topic spectrum.GPT-3.5, constructed more heavily on GPT-3, incorporates better contextual awareness, response accuracy, and the capability of sustaining long conversations. OpenAI API enables developers to incorporate such models in chatbots such that they can harness the power of complex machine language models without needing high-level machine learning expertise. Such democratization of artificial intelligence has enabled developers and companies to build chatbots responsive and strong enough to respond to users' concurrent queries. The GPT models are the benchmarks for conversational AI as they are capable of producing responses natural-sounding like users and contextual to the query, hence perfectly suitable for customer support, virtual assistants, and interactive software.

2.6 Use Cases and Applications of Chatbots:

Chatbots are used in a vast range of industries due to their capacity to simplify communication and automate processes. In customer support, chatbots are extensively used to respond to routine questions, offer troubleshooting tips, and even process transactions, minimizing human intervention and enhancing the response time. In online shopping, chatbots assist the customers in navigating the shopping process, suggest products, and assist in order tracking. Healthcare chatbots are also on the rise since they provide pre-medical consultations, scheduling of appointments, and medication reminders. Additionally, in education, chatbots can be used as virtual tutors or paperwork assistants, helping question-asking students or providing additional resources. The biggest advantage of these tools is that chatbots improve the user experience through 24/7 assistance, instant replies, and decreasing the workload of humans, thus making businesses operate efficiently.

2.7 Challenges in Chatbot Development:

Despite advances in chatbots, their design continues to face many challenges. One of the largest among these is contextual understanding chatbots, particularly those based on less advanced technologies, can struggle to grasp witty dialogue, idioms, or parsing ambiguous questions. As an example, chatbots can get bogged down by sarcasm or have poor conversational flow between a series of turns. Secondly, data security and protection are a continuous concern, especially where chatbots handle sensitive information. The majority of users are not comfortable sharing personal information with automated systems, which has ethical implications on data handling and privacy.

SL.NO	TITLE	AUTHOR(s)	YEAR	REMARK
1.	"CoalWizard: Mining Industry Chatbot."	Shreyas Dixit, Omkar Khade, Atharva Divekar, Maruf Khan, Suyash Yeolekar, Urvi Shah.	2023	AI chatbot for mining laws using LLMA2 platform.
2.	"MineBot: Chatbot for Mining Acts."	Armaan Seth	2023	NLP-based chatbot for Indian mining regulations.
3.	"AI Chatbot for Coal Mining Industry."	Siddhant	2023	Chatbot using PETALS and Pinecone for coal mining info.
4.	"AI-Powered Chatbot for Mining Regulations."	AdeshShinde, Omkar Naikade	2023	Discusses chatbot implementation in mining automation.
5.	"The Coal Miner AI Chatbot."	Swaroop, Nikhil, Abhinav, Srikanth, Rohit, Shanmukh, Sahithi	2023	Multilingual chatbot for mining queries with voice/text input..
6.	"MiningMind ChatBot."	M. Mohan Raj, M. Jayaranjini,	2023	Chatbot for mining regulations using NLP techniques.

		D. Rajasekar, R. Sowmiya, M. Suganthan, SA. Jeevitha		
7.	"Act Master: Chatbot for Mining Acts."	feignbird	2023	Chatbot responding to mining acts using LangChain and GPT4All.
8.	"MILA: Mining Industry Legal Assistant."	Shivesh	2023	Chatbot for mining compliance using Llama 2 and LangChain.
9.	"Large Language Model for Chatbot."	Prof.TruptiFarande, Vishal Waghmare, RushikeshBarkade,	2023	Proposal for 24/7 chatbot addressing mining legal queries.
10.	"LawPal:ARetrieval Augmented Generation Based System for Enhanced Legal Accessibility in India."	Dnyanesh Panchal, Aaryan Gole, Vaibhav Narute, Raunak Joshi	2025	RAG-based chatbot for accurate legal information retrieval in India.
11.	" LawGPT 1.0: A Virtual Legal Assistant Based on GPT-3."	Ha-Thanh Nguyen	2023	GPT-3 based virtual assistant for legal queries and document generation.
12.	" LEGAL-BERT: The Muppets straight out of Law School."	Ilias Chalkidis, Manos Fergadiotis, Prodromos Malakasiotis, NikolaosAletras,	2020	BERT model adapted for legal domain tasks and applications.
13.	" Drillie: Legal Mining Guide Chatbot."	Raaasin	2023	Chatbot providing assistance on mining operations and regulations in India...

14.	" Genie AI for Mining."	Genie AI Team	2024	AI platform streamlining legal processes in mining industry.
15.	" AI-Based Platform for Automated Labor Law Compliance Associated With Mining Operations."	MarufKhan, Suyash Yeolekar, Urvi Shah.	2023	Patent for AI platform ensuring labor law compliance in mining operations.
16.	" CoalMitra: WhatsApp Chatbot by Coal India Limited."	Coal India Limited	2023	24/7 WhatsApp chatbot for grievance redressal and vendor bill tracking.
17.	" RoyBot: AI Chatbot for Roy Hill Mine "	RoyHill Technology Team	2023	GPT-powered chatbot assisting employees with production data and HR queries.
18.	" Chatlaw: A Multi-Agent Collaborative Legal Assistant with Knowledge Graph Enhanced Mixture-of-Experts Large Language Model."	Jiaxi Cui, Munan Ning, Zongjian Li, Bohua Chen, Yang Yan, Hao Li, Bin Ling,	2023	Legal assistant using MoE model and knowledge graphs for improved accuracy.
19.	" AI Technology Combating Illegal Mining and Mineral Transportation in Uttar Pradesh.”	Geologyand Mining Department, Uttar Pradesh Government	2024	AI & IoT-based unmanned check gates and M Check app for enforcing legal mineral transportation.
20.	" AI-Based Legal Assistant for Mining Industry Regulations."	National Institute of Technology, Mining Department.	2024	AI-powered assistant for streamlining legal queries in the mining industry.

2.8 Summary

The mining sector is regulated by a set of matured Acts, Rules, and Regulations that aim at promoting safety, efficiency, and compliance with national and environmental standards. Some of the most important regulations are the Coal Mines Act, 1952, Indian Explosives Act, 1884, Colliery Control Order, 2000, and several others that deal with wages, safety standards, and land policy. But it is tedious for mine operators, lawyers, and others to sift through these reports. Better than this, the Ministry of Coal recommends the creation of an AI-based chatbot. The chatbot will employ Artificial Intelligence (AI) and Natural Language Processing (NLP) so that it can comprehend questions asked by the users about the mining laws and respond with timely and accurate information. The stakeholders will be able to access different Acts, Rules, DGMS Circulars, CoI Proceedings, and land laws such as CBA, LA, and R&R via the chatbot. Operating 24/7, the chatbot will provide greater accessibility, reduced labor-intensive manual searches, and greater regulatory compliance. Its ease of scalability will also improve stakeholders from remote areas, making legal information more transparent and accessible throughout the mining sector.

2.9 Chatbot History

Chatbots have undergone a great evolution-from the simplest rule-based systems to highly sophisticated neural language models like GPT and BERT. Previous chatbots such as ELIZA and ALICE were based on pre-programmed scripts that had no contextual information. AI-powered chatbots of today are large-scale transformer models that generate coherent, context-aware responses.

2.10 Chatbots in Specialized Domains

Advancements in the last few years have allowed for the use of chatbots in areas such as:

- Health (for example, Babylon Health)
- Legal (for example, DoNotPay)
- Education (e.g., AI tutor on Quizlet)

- Banking and Finance (e.g., Erica from Bank of America)

Mining, on the other hand, is an industry that remains inadequately served when it comes to the use of AI. Although some efforts are made towards the automation of safety monitoring and operational decision-making, few are aimed at regulatory compliance or cheap legal advice.

2.11 AI Models for Legal and Regulatory Texts

The transformer models, such as OpenAI's GPT-3.5 used in your project, have been demonstrated to be effective at understanding complex papers, summarizing laws, and generating lawfully correct text. Fine-tuning these models on domain-specific data has led to better accuracy in contract, legislation, and compliance use cases.

2.12 User Experience in AI-Driven Interfaces

An AI chatbot should be intuitive, beautiful, and easy to use. The modern UI/UX standards recommend the inclusion of features such as:

- Modal signup/login windows
- Voice input for accessibility
- Profile management
- Floating chatbot windows

These elements exist in your implementation, and they are the best practices for chatbot user interface design.

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

3.1 Expansion of Knowledge Base:

The present methodologies are dependent on static knowledge bases, thereby they do not possess the ability to manage perpetual updates in mining legislations and DGMS circulars. Research activities can be directed towards creating dynamic as well as self-updating knowledge bases that automatically embrace updates on mining legislations, DGMS circulars, and best practices.

3.2 Legal Language NLP Accuracy:

The current NLP models are hardly effective in understanding industry-specific and complex legal terminologies. Creating other NLP models that are meant to understand industry-specific and legal jargon can enhance the chatbot in providing accurate responses.

3.3 Multilingual Support Constrained:

Current chatbots in mining only support a single or, at most, two languages. Widening the support base to a pool of local languages under which miners work can make the system more global and accessible to more people. Particularly, in mining's rural domain.

3.4 Context Retention:

There is no context retention in most current chatbot systems if the conversation is extensive. Context retention and monitoring long-term questions would improve so that the chatbot could support sophisticated, multi-turn conversations on mining regulations.

3.5 Integration of Real-Time Data:

Chatbots are not generally linked to real-time data feeds like the latest mining news or releases from regulatory agencies. Future research can investigate how government websites, news websites, and real-time data feeds from regulatory agencies can be integrated so that users can be alerted to the latest updates.

3.6 Mining Industry-Specific Chatbot Training Data:

Current practice trains chatbots on generic data sets, which might not cover the specifics of mining industry regulation. A joint research program to develop training datasets for mining acts, rules, and circulars can enhance chatbot appropriateness and response quality.

3.7 Visual Query Support:

The chatbots of today are text-based, but in sectors such as mining, sometimes visual information such as diagrams, rules in PDF format, or photographs is required. Work may investigate the evolution of visual query systems where the user can upload documents or pictures to obtain matching legal information.

3.8 User-Intent Prediction:

New systems sometimes get the user intent wrong, particularly where the language is not clear or the question asked is long. Optimization on intent classifying models through deep learning technology like transformers or hybrid models could help in making the predictive power of the chatbot more enhanced.

3.9 Filtering Importance of Compliance Queries:

Another problem with existing systems is that they give too large or unrelated output. Creating sophisticated query filtering systems to restrict output to strongly relevant compliance material would eliminate noise in chatbot response.

3.10 Security and Privacy Issues:

Chatbots may create issues with sensitive data. Confidential and personal data are governed in the mining sector. Studying safer encryption methods, secure authentication procedures, and data protection legislation for legal inquiry may provide better security and compliance.

3.11 Limitations Found

Apart from chatbot technology and its industries, there exist certain limitations of the existing processes, especially for the mining industry sector:

- **Lack of Domain Knowledge:** Most of the AI-powered chatbots are developed using general-domain knowledge. Mining domain-specific legal knowledge is not added mostly.
- **Insufficient Document Handling:** Existing bots never include aspects of managing lengthy, complex, and inter-related regulation documents.
- **Limited Offline Support:** The majority of chatbots are cloud-based and do not allow offline querying and data caching of any kind.
- **User Interaction Limitations:** The majority of mining platforms are not user-friendly and have not got a straightforward, interactive frontend, restricting access to non-technical users.
- **No Personalization and History Storage:** Most bots fail to store history of the conversation or track changing user needs and query patterns.

CHAPTER-4

PROPOSED MOTHODOLOGY

4.1 Architecture

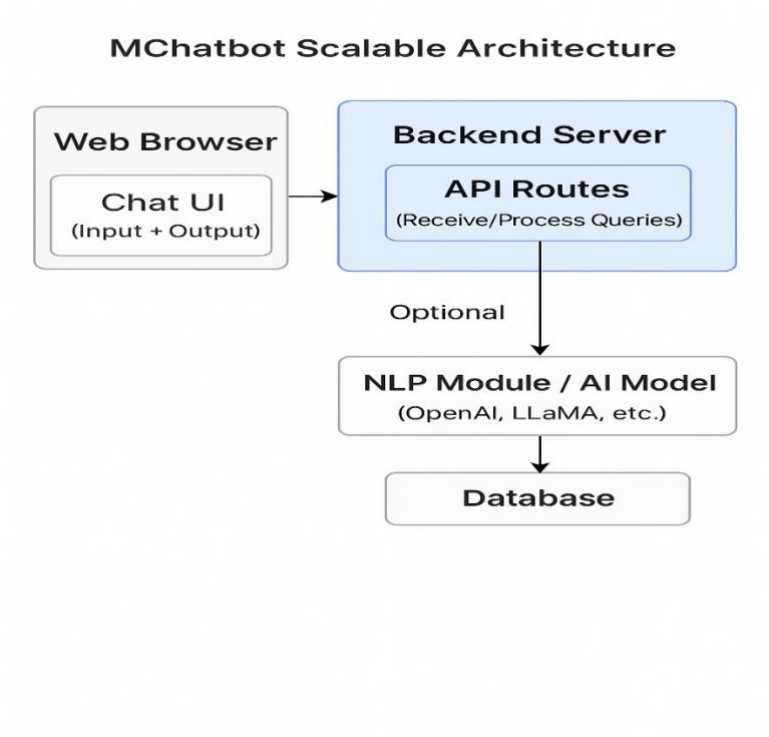

Figure 4.1: Flow Chart Architecture

4.2 User Interface (Web Browser)

•Implemented in the form of HTML, CSS, and JavaScript.

•Consists of the chat widget, message box, and input box.

•Handles user inputs like typing, sending messages, and showing replies.

•Passes user input to the backend for processing.

4.3 Backend Server (e.g., Node.js or Flask)

•Is the middle layer between the frontend and the logic of the chatbot.

•Processes user input and passes it to the NLP or AI module.

• Processes response to be rendered on frontend.

• May contain authentication and routing logic if needed.

4.4 NLP / AI Model (Chat Logic)

- Is responsible for understanding and generating responses.
- Can be powered by:
    - Pre-trained APIs (like OpenAI, Cohere)
    - Custom-trained models (like LLaMA, Falcon) run on a server.
- Enables domain-specific smart conversations.

4.5 Local Storage (Data Persistence Layer)

- Used to cache chat history or user sessions locally on the client (in the browser).
- Ideal for light applications where a complete database is not needed.
- Data saved can be retrieved even if the user refreshes the page.
- Can hold:
- Pre-viable messages
- Session cookies
- User preferences or temporary user information

4.6 Frontend Implementation

Frontend of chatbot application is developed in a view of a simple-to-operate interface upon which the users get to talk with the bot. It comes in the manner of HTML, CSS, and JavaScript code allowing ease of controlling user interface. Below steps provide information about frontend architecture:

Chatbot Icon and Interaction

Floating chatbot icon is bottom-right pointed on the screen serving as an initializer to open the chatbot window. The icon is achieved using CSS to give an aesthetic clickable button that could be tapped by the users to start a conversation with the bot. When tapped, the icon disappears, and the chatbot window pushes the screen.

Chatbot Container

The chatbot window consists of a header, body, and input section. The header displays the title "Chatbot" and close button by which the user can close the chatbot window. The body displays the conversation of the bot and the user in which the bot's message and the user's message are displayed. The input displays a text box in which the users input their messages and send button by which they send their messages. The framework is equipped with a responsive and interactive user interface.

Message Handling

User messages are added to the chatbot's message container in a default manner to distinguish between user and bot messages. Bot message is made with dark gray background color and left alignment, and user message is made with red background color and right alignment. This distinction simplifies differentiating and enhances the user interface.

4.7 Backend Integration

The bot's backend is powered by the OpenAI API, where the bot answers the user's queries. The process below describes how the backend is integrated with the application.

API Integration with OpenAI

The core functionality of the chatbot is sending user messages to the OpenAI API and capturing relevant responses. The JavaScript program is waiting for the click event of the send button and processing the user input. It's sending an API request on OpenAI's GPT-3.5 model with the message text content and capturing the response of the bot.

API Request Structure

To send the message to OpenAI, there is a POST request to the OpenAI API endpoint (https://api.openai.com/v1/chat/completions). Authentication and content-type headers are sent with the request along with the body that puts the user message in the correct format:

json

Copy code

```
{
  "model": "gpt-3.5-turbo",
  "messages":
    [{ "role": "user", "content": "userMessage"}],
  "max_tokens": 150
```

This configuration makes it possible for the chatbot to reply using natural language from OpenAI's model to an inquiry from the user. Error Handling

Aside, for the reasons of safety, the system even includes error handling in case the API request proves to be invalid. In the case the bot fails to obtain a response, it reports back an error message, default as it may, to the user. This protects the usability of the interface as much as possible since it provides feedback on a failure occurring.

4.8 User Experience Flow

User experience comes center stage throughout this plan. User chatbot conversation flow must make sense and should naturally be:

1. User Touches the Chat Button: The chatbot interface doesn't come on top all the time, waiting until the user taps the floating chat icon.

2. User Types in a Message: The user can type a message within the text box for entry when the chatbot window is opened.

3. Message Sent: Once the send button or "Enter" key is clicked, the user message is posted on the bot. It is seen in the conversation window.

4. Bot Responds: The bot keeps the user post message open on OpenAI's API and waits for the response thereafter. After getting the response, the bot displays the response in the conversation window.

5. Repeat Interaction: The message and response get repeated as and when needed.

This results in a dynamic and continuous dialogue between the user and the bot with an unstructured and organic form that is conversational.

4.9 Technologies Utilized

Technologies utilized in the development of the chatbot app are as mentioned below:

Frontend:

• HTML: Used to structure the chatbot layout and design the chat window and input area design.

• CSS: Responsible for styling the chatbot UI, including the floating icon, bubbles, and input field.

• JavaScript: Controls the interactivity, like hiding/showning the chatbot, posting user messages, and communicating with the OpenAI API.

Backend:

• OpenAI GPT-3.5: OpenAI's GPT-3.5 model drives the backend, handling the user input and generating human-like output.

• Fetch API: JavaScript fetch API is employed to post the user message on OpenAI's API and handle the API response asynchronously.

4.10 Future Improvements

Though the current deployment is a full-fledged chatbot, following are some of the updates to be implemented in the future:

1. User Authentication and Profiles:

Addition of user authentication provides experience personalization to the users. They can provide a profile, store their conversation history, and receive personalized replies based on their previous conversation.

2. Improved Error Handling

More can be done in error handling such as retries for failed calls, or improved error messages to guide users when everything is not going in the correct direction.

3. Multi-Language Support:

Future versions can have multi-language support to make the chatbot more usable, where the user can interact with the bot in various languages.

4. Contextual Responses:

Enhancing the memory of the chatbot for the history of the sentences uttered previously during the conversation can give the conversation more seriousness and significance to the user.

CHAPTER-5
OBJECTIVES

5.1 Main Objectives

The ultimate aim of this project is to develop a chatbot platform for the legal and operational needs of the mining industry. Following are some specific objectives:
Design a conversational AI interface via which end-users can interact with a bot trained or prompted on mining regulations. Integrate OpenAI's GPT-based models to provide intelligent, context-aware responses to user queries. Offer multi-mode input modes like text, voice, and file upload to assist it in various ways. Offer interactive and responsive frontend design with the advantage of next-gen web tech to provide extended support for it accessed by multiple users on diverse devices.

5.2 Implementation-Based Practical Goals

Below practical goals have been followed or will be followed based on your code and system design:

- Login/Signup Feature: User registration and log-in based on phone number or email.
- Profile Interaction: Hover profile icon to view authentication option.
- Chat Session Management: Buttons to start a chat, close window, view or delete history.
- Real-time Message Processing: Dynamically shown messages with user-bot message differentiation.
- Voice Integration: Users can use in-browser speech recognition to voice search queries.
- File Upload Feature: Allows users to attach documents, with possible document parsing functions in the future.
- API Integration: Connection with OpenAI's GPT-3.5 API for natural language processing.
- Modal Popups: Login and signup are accomplished via modals to keep the user within the same interface.

5.3 Long-Term Goals

Train or fine-tune an open-source model (e.g., LLaMA, Falcon) on mining documents to reduce use of paid APIs.Allow personalized learning by storing the most commonly asked questions and responding to them. Offer multi-language support to serve customers in various Indian states or overseas mining communities. Offer offline or low-bandwidth capability to enable usage in remotely networked mining camps.

5.4For Providing Real-Time Access to Legal and Regulatory Information:

The prime objective is to offer timely, correct information regarding various mining acts, rules, and circulars. Mining industry players always need real-time explanations of legislations such as The Coal Mines Act, Indian Explosives Act, and DGMS Circulars. Traditional methods such as reading legal documents or consulting legal advisors take a lot of time. A chatbot will render it automatic, delivering stakeholders with immediate verified answers to facilitate greater efficiency and compliance. The purpose thwarts delay, especially where timeliness in decisioning is critical for safety, operation, or legitimacy.

5.5 To Improve Comprehension of Complex Legal Terminology:

Regulatory and legislative writings are prone to incorporate complex technical jargon that then becomes challenging for legal novices to interpret.

This objective is designed to simplify the legal content so that it becomes easier to read in simple terms through the chatbot.

Through Natural Language Processing (NLP), the chatbot will interpret user questions and simplify the intricate legal jargon into easy-to-understand explanations. This will allow workers, contractors, and administrative personnel in the mining industry to understand their rights and responsibilities clearly. It bridges the communication gap between operational activities and regulatory legislation to ensure better understanding and implementation of rules at the practical level.

5.6To Ensure 24/7 Information Availability:

The chatbot will be operating day and night because human professionals do not have fixed working hours.

The concept is to provide legal, regulatory, and procedural information about mining 24/7. Employees who work in varying shifts, remote locations, or in other time zones will value round-the-clock availability. It also proves useful in urgent situations where regulatory clarification is needed immediately. The system's ability to function twenty-four hours a day means users are never abandoned without assistance, thus the environment in which the mining is carried out is made safer, more compliant, and sensitive to regulations.

5.7For Enabling Compliance and Decision-Making Processes:

Legality in law compliance is an acute issue within the field of mining, whereby monitoring of any sort brings sanctions of the law or firms are shut down. The chatbot will become an assistance compliance tool by making appropriate and updated information available through trustworthy sources. The chatbot provides support for decision-makers as it offers legal certainty in such instances as regards land legislation, legislations concerning labour safety, wages law, and environmental legislations. With integration of the chatbot within the day-to-day processes, it enables the firms to diminish the risk of compliance, have good decisions made at the opportune moment, and capture these interactions for audit trails. This objective guarantees that there will be smooth operations that are in accordance with current laws.

5.8 To Develop a Scalable Knowledge Management System:

This objective is in terms of developing a system that scales in the long term to handle growing queries and documents. Each time new circulars, amendments, or laws are added, the backend of the chatbot will be updated so that it is always up to date. The system develops from interactions and expands its database on a daily basis. In this way, it is not only a stationary FAQ bot but also a changing legal aid which can adapt itself to new legal scenarios.

CHAPTER-6
SYSTEM DESIGN & IMPLEMENTATION

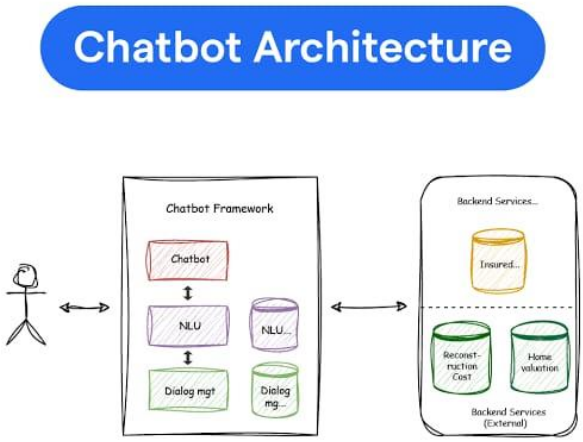

Figure 6.1: Architecture

It can even be made scalable to accommodate any screen resolution and can therefore be deployed on any hardware. For backend scaling, the OpenAI API can be invoked securely through the Node.js/Express server while keeping the sensitive information such as API keys secure. It can potentially be extended with user authentication, interaction analytics tracking and storing conversation history in a database for history-based experiences. For other features, more functionality like multi-language, speech-to-text input and rich media output can be included later. Features like API key secrecy, request limiting, and correct CORS configuration are required to make the system secure and dependable. The system as a whole is perfect to be utilized as the basis upon which a dynamic, interactive chatbot could be built, and which could be tailored and sized to suit users' requirements.

6.1 Implementation

- **ChatBot :** A chatbot is an artificial computer program that perform human conversation with customers, often in the form of text, and it will respond to queries which user provide information.
- **NLU:** Natural Language Understanding (NLU) is a field of computer science and AI that focuses on enabling machines to understand and interpret human language,
- Going beyond simple pattern matching to derive meaning, context, and intent.

- **Dialogue Management:** The system analyzes the user's input to determine their intent or goal, such as booking a flight, asking a question, or completing a task.

- **User :** The user will give the queries to chatbot to get answer from chatbot.

- **Reconstruction Cost:** Chatbots can access external services via APIs to retrieve this information, helping users estimate repair costs.

- **Home Valuation:** chatbot can be
    - programmed to estimate a property's value
    - based on its location, size, and recent sales
    - data in the surrounding area.

6.2 Front-end Architecture

1. Welcome Page (Start Chatting)

- Acts as the entry point to the chatbot.
- Includes a prominent button to begin interaction with the chatbot interface.

2. Chat Interface (User Inputs)

- Central component for users to enter their queries.
- Displays responses dynamically from the chatbot.
- Built with JavaScript to handle real-time interaction.

3. Simple Interface Design

- No login/signup required — anonymous chatting for users.
- Ensures fast access and smooth user experience.

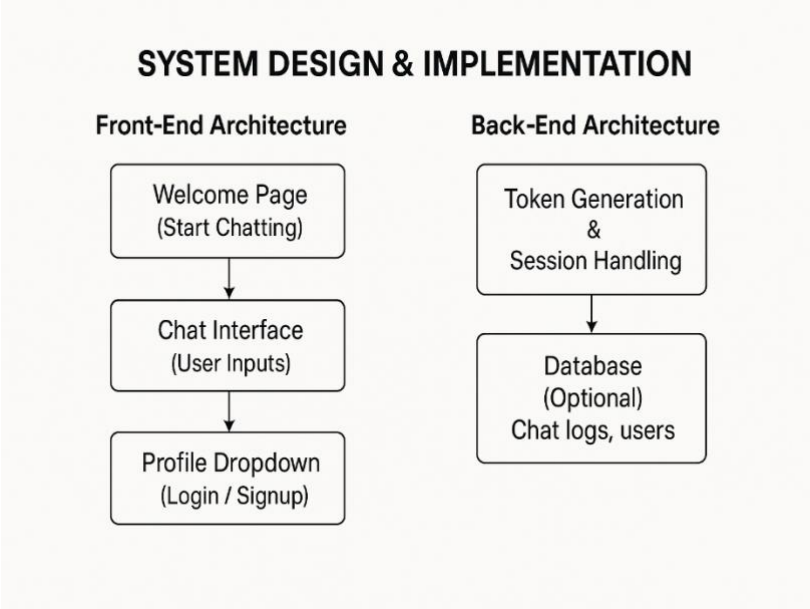

Figure 6.2: Front-end And Back-end Architecture

6.3 Back-end Architecture

1.Session Handling (Optional)

- Handles temporary user sessions without authentication.
- An uninterrupted chat experience for the visit.

2.Database (Optional)

- Used to record chat logs or supply context for follow-up questions.
- Optional storage for future chatbot optimization or analysis.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT

(GANTT CHART)

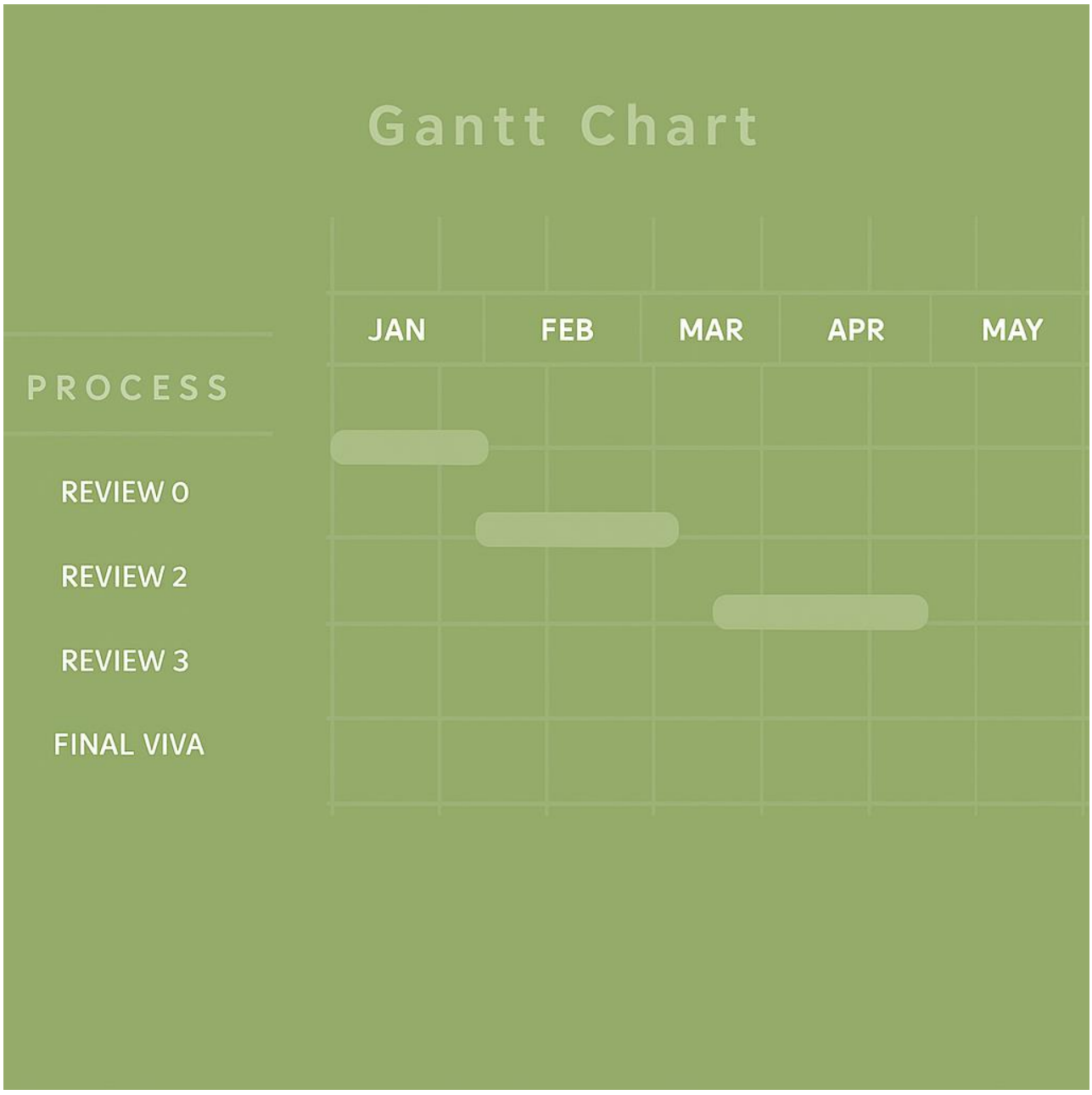

Figure 7.1 Timeline

CHAPTER-8
OUTCOMES

The Mining Industry Chatbot project was successful in developing a full working and properly designed web-based chatbot interface using HTML, CSS, and JavaScript. The welcome page is properly designed with a floating chatbot icon, a bold welcome message, and a Start Chatting button to open the chatbot window. There is a profile icon in the top right-hand side, on which click, there is a dropdown with Login and Sign Up. These are used to trigger respective modals in which users can enter their credentials, providing the site with minimal user authentication UI. The modals have a dark theme similar to the rest of the site's look and feel and provide an immersive user experience with clean input fields and styled buttons. Once the conversation has begun, the sidebar appears, providing settings to view and clear chat history. The chatbot window is a properly designed fixed pane with a title, scrollable message content, and an input box that accepts text input, voice input via Speech Recognition API, and file upload option. Message bubbles differentiate user and bot messages with alternative styles for improved readability.

Voice input is smoothly supported, hence users can send messages via voice, thus enhancing the usability of the platform. Secondly, client-side JavaScript controls UI interactions effectively such as controlling dropdowns to show or hide, open and close modals, add new messages, and refresh the page. The control of visibility of chat history is controlled by a button, and it is easy for users to remove conversation logs. Following minimalist yet effective animations, interactive elements, and a new dark UI theme, it becomes feasible for a professional user experience. The project overall has been successful in its endeavor to have an interactive, responsive, and easy-to-browse chatbot portal optimized specifically for deployment within the mining sector with a robust foundation to integrate further backend features such as Firebase authentication or database-stored chat history storage. The achievement fulfills all the key requirements of having an enjoyable, useful, and scalable chatbot platform.

User Interface and Experience Outcome:

The interface adopted is appropriate for a contemporary and user-centric user experience for a mining sector chatbot application. On page loading, users are greeted with a clean-looking welcome page with floating chatbot icon, welldresseded welcome message, and a "Start Chatting" button. Also, the top right profile icon supports login or sign-up using a dropdown menu, including user interaction and usability. Login and sign up are both accommodated by modal windows, opening smoothly and matching the dark color scheme of the rest of the interface. Overall, the clean UI design, smooth transitions, and interactive elements promote ease of navigation and provide a professional look and feel aligned with industrial applications.

Functional Outcomes and Chatbot Behavior:

Functionally, the chatbot offers interactive messaging capabilities using OpenAI's GPT-3.5-turbo model. Users can input messages via a text input field or utilize voice input via the Web Speech API, which is particularly useful for accessibility and hands-free use. The bot also includes some simple pieces of messaging sending and receiving, presenting the messages in easily readable form via colored styles to make the user's messages distinguishable from bot's and offering scrollable history for the conversation. The inclusion of "History" and "Clear History" buttons makes the interface user-friendly by enabling users to read or clear their conversation. A file upload button is utilized to upload users' files, but it is now utilized to simulate file input interaction by uploading uploaded filename. This capability is being leveraged as a stepping stone to higher-level development in the form of document analysis or content extraction from uploaded documents.

Technical Architecture and Extensibility

Technical application of chatbot is separated into content (HTML), structure (CSS), and logic (JavaScript) for scaling and serving. Dynamically, UI interaction is handled by JavaScript code, modal show/hide, message display, and API calls. While in the code below an hardcoded OpenAI API key is employed—good enough for learning's sake—the production deployment in the real world would need a secure proxy backend to deal with keys and maintain security. The project is modularized in such a manner that it is simple to implement additional features like Firebase

authentication, server logs, or chat history storage in a database. The project is view-and-desktop-responsive, hence cross-browser compatible on a majority of devices. In sum, this codebase constitutes a good foundation for a fully operational and extendible mining industry chatbot platform which could best be expanded using AI tuning, data sets pertaining to the domain, and enterprise-oriented features.

8.1 Instant Legal Information

The clients are offered instant solutions to the questions that arise in connection with mining law, guidelines, and regulations, and hence wastage of time for searching legal documents and compliance at the right time becomes easy as pie.

8.2 Improved Legal Awareness

The bot converts complicated legal language into simple words, thereby regulatory jargon becomes simple for the professionals in mining to make cases of non-compliance to be authenticated.

8.3 24/7 Support

The chatbot works twenty-four seven, allowing users from all shifts and time zones to be able to access critical information at any moment without relying on legal personnel.

8.4 Efficiency of Operations

Automated answers to common legal queries reduce operations delays, and staff can engage in more strategic and productive work.

8.5 Minimization of Legal Interpretation Error

The platform uses NLP and AI to generate standard and correct legal responses, thereby avoiding human fallibility and interpretation that lead to compliance issues.

8.6 Centralized Management of Information

All the legislation, regulation, DGMS circulars, and amendments are maintained and retrieved from one source, creating a centralized legal know-how repository for mining.

8.7 Decision-Making Support

Live legal advisory enables field staff and management to take respective legislations-based decisions, keeping exposures to the law at minimum.

8.8 Integration with Management System

The chatbot is integrable with current management information systems for providing seamless workflow, automated documentation, and quality regulatory reminders.

8.9 Training and Onboarding Tool

It is an in-house tool for training new employees regarding mining legislation, to enhance their induction process and ensure early compliance.

8.10 Scalability and Future Expansion

The system is scalable as well to grow to accommodate additional laws, languages, and jurisdictions in order to grow with organizational need and market variation.

CHAPTER-9
RESULTS AND DISCUSSIONS

The Mining Industry Chatbot application software, by proof of concept and design, is an all-inclusive front-end package that elegantly combines next-generation UI/UX ideas with the core chatbot functionality. The welcome screen design is the ideal start to the application and thus a warm and engaging entrance to the program. With the dark-designed layout and with the hovering animating chatbot icon, the interface has the clean and professional look that is suitable for the technical industries of mining. With the large "Start Chatting" button and with an easily clickable profile icon, it has smooth first-time user experience. The interface is also made in such a way that the focus of the user towards the interaction process with the chatbot is maintained right to the last, eliminating all the distractions as well as interaction complexity. One of the features of the process is the secondary sign-up and login modals that are caused by prompting a dropdown against the profile icon.

This implementation choice enhances the user experience by providing access to authentication without page reloads or redirects. The modal windows are minimal and are together with dark theme as a whole and professional in looks. Modal toggling via clean but effective JavaScript code and along with user input fields tidily stacked results in the transition from login, signup, and the primary interface being smooth. While Firebase or some other backend service will still be needed to integrate for real-time user authentication and management, the front-end architecture itself is a good foundation for future backend integration. The chatbot itself is within a fixed position container that simulates the actual context of real-time messaging.

Various paths for user interactions such as text input, file upload, and voice input through Web Speech API are accommodated by the architecture. Several input paths expand the application to a large class of users with different interaction requirements. WebkitSpeechRecognition provides voice interaction, which is highly convenient in manufacturing environments where keyboarding may not always be feasible. The voice input is scanned to text automatically, making it more convenient in hands-free usage—a potentially lifesaving feature in field use or when operators are operating in hostile environments. The underlying functionality of the chatbot is described using

API integration of the OpenAI GPT-3.5-turbo model to create smart, context-based responses to queries from a user.

While use of a hard-coded API key is unsafe and not for a production setup, it is available as proof of chatbot integration in a learning or development environment. The answer retrieval response is asynchronous, allowing the application to remain responsive while the bot handles user requests. The responses look visually distinct, obviously distinguishing bot and user messages and therefore improving readability. Additionally, the presence of a scrollable message area means conversation history can be accessed by reading forward to resume long message conversations. Lastly, using a sidebar containing "History" and "Clear History" buttons provides useful conversation management functionality.

Though current implementation has proven message clearing as well as toggle behavior for a history box, persistence of history (e.g., local and/or database storage of messages) needs to be implemented. It is a valuable feature in applications in the real world where it may be necessary to refer to previous conversations or keep pace with something. Scaffolding that is implemented in the current interface can be refined in subsequent releases by employing examples from log systems or storage systems to retain history. Neat as it is, the current implementation does have some flaws.

Firstly, there is no validation or error checking for signup and login forms, so users are free to proceed with null or malformed data. The addition of client-side validation would go a considerable distance toward UX and security. Similarly, there is no decent backend integration of user sessions so that all users are chatting anonymously with the chatbot without any possibility of personalizing response or even decent management of user data. Finally, hard-coding of the OpenAI API key is a major security risk. It should be treated as an environment variable for production and retrieved using a secure backend proxy. Additionally, the present chatbot is stateless. It only acts on the latest user message without consideration of prior context other than screen-visible visibility. This limits its usefulness for future application to more advanced actions such as form submission, step-by-step regulation mining instruction, or dynamic learning. Incorporating session-awareness and natural language memory functions would significantly contribute to the intelligence and usefulness of the chatbot to real mining applications.

HTML Implementation

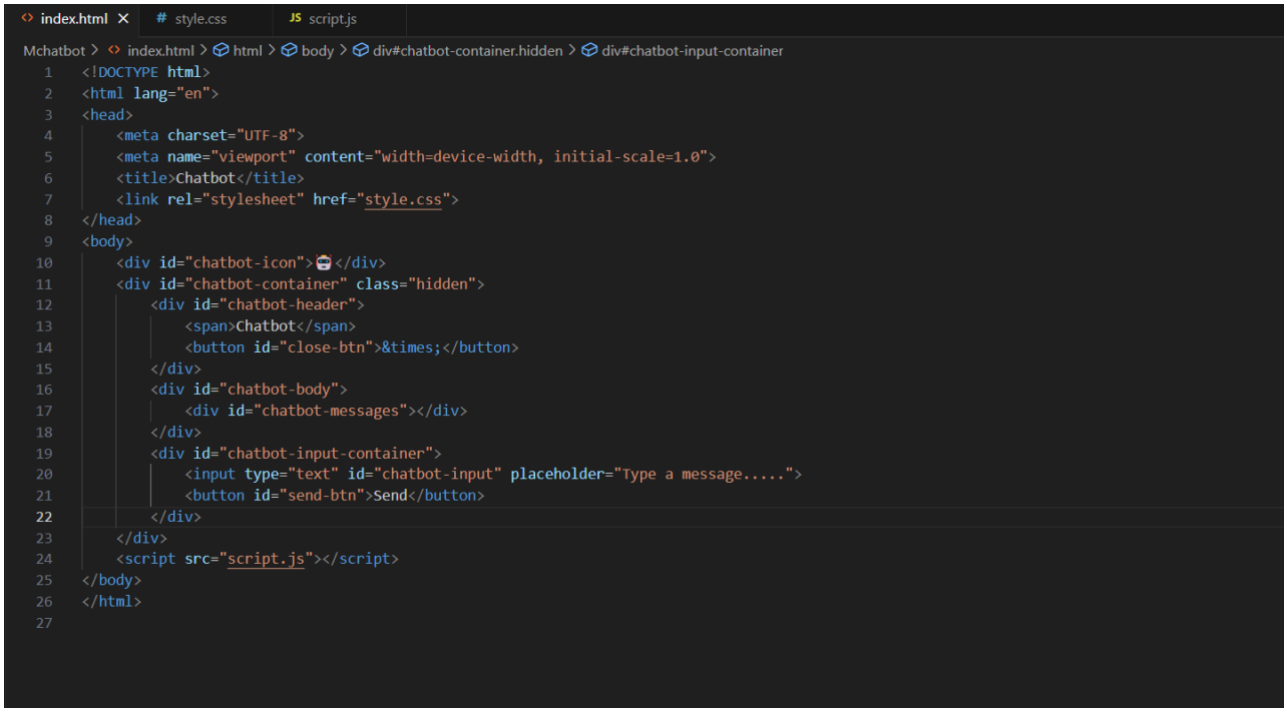

Figure 9.1 : HTML

HTML section of the project is the thinking component of the chatbot application. It takes care of making the entire user interface, i.e., welcome page, chat window, profile icon, signup and login form. Semantic HTML elements have been implemented for accessibility and proper structuring of content. There exists a "Start Chatting" button on the welcome screen which brings users to the main chat interface. Also, the profile icon in the top-right corner has the option of login/signup via email or phone number. The organization opens the gate for an elegant and minimalist interface.

HTML, or Hypertext Markup Language, is the standard language used to create and design webpages and web applications. It provides the structure for web content by defining elements like headings, paragraphs, links, images, tables, and other types of media. HTML uses tags, which are enclosed in angle brackets, to mark up different types of content on a page. These tags help browsers understand how to display the content. For example, the <h1> tag defines the main heading, while the <p> tag represents a paragraph of text. HTML allows web developers to create structured content that is interpreted by web browsers to display on a user's screen.

CSS Styling

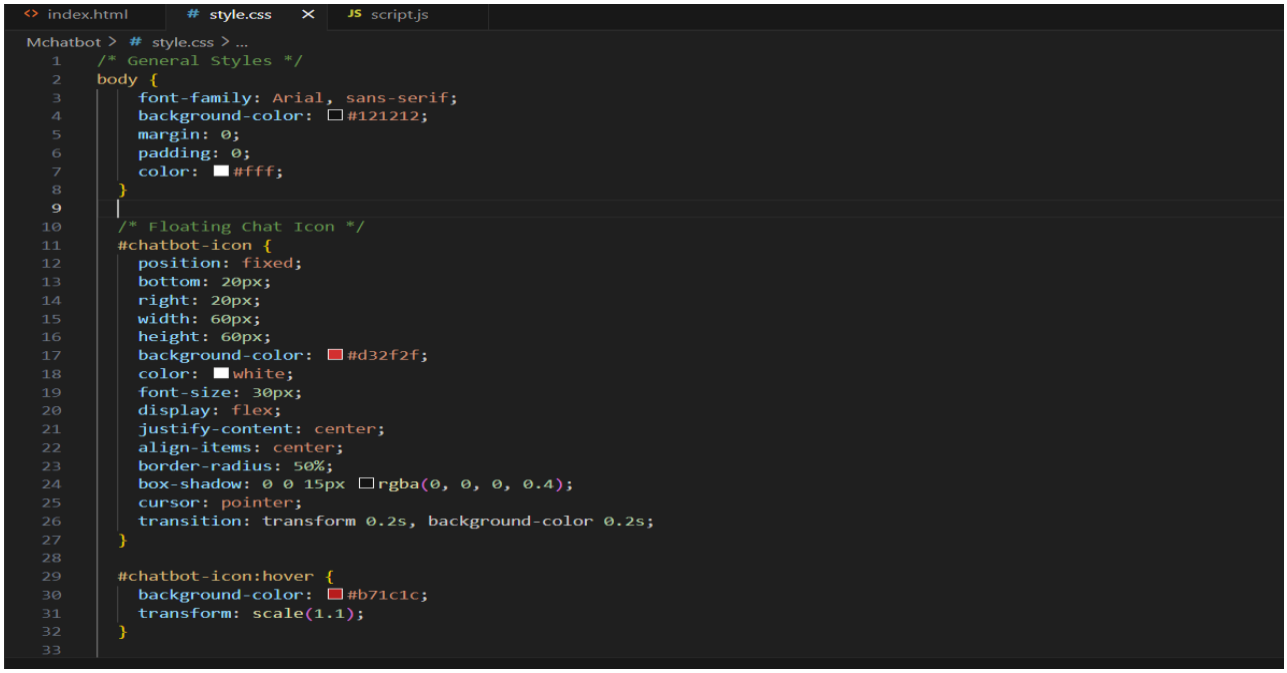

Figure 9.2 : CSS

CSS has been used to provide a nice-looking interface for the chatbot application. CSS has been used to set the layout, colors, fonts, and spacing that will yield a professional and easy-to-use interface. Styles have been used to provide a nice-looking welcome page with clean buttons as well as layout alignment. The profile dropdown menu has been kept clean and minimalist upon click. Responsive design fundamentals have also been utilized to structure support for a variety of screen resolutions and other hardware so that it is readily available and accessible on every platform.

CSS, or Cascading Style Sheets, is a style sheet language for describing the appearance of a web page created in HTML or XML. It determines the layout, appearance, and overall look of web content. CSS enables developers to apply multiple styles to HTML elements, including modifying colors, fonts, spacing, positioning, and adding transitions or animations. By isolating the structure (HTML) from the style (CSS), it makes sites more maintainable and flexible since design modifications can be achieved without modifying the underlying HTML content. Using CSS, a developer can make a site look the same on any device and screen size.

JavaScript Functionality

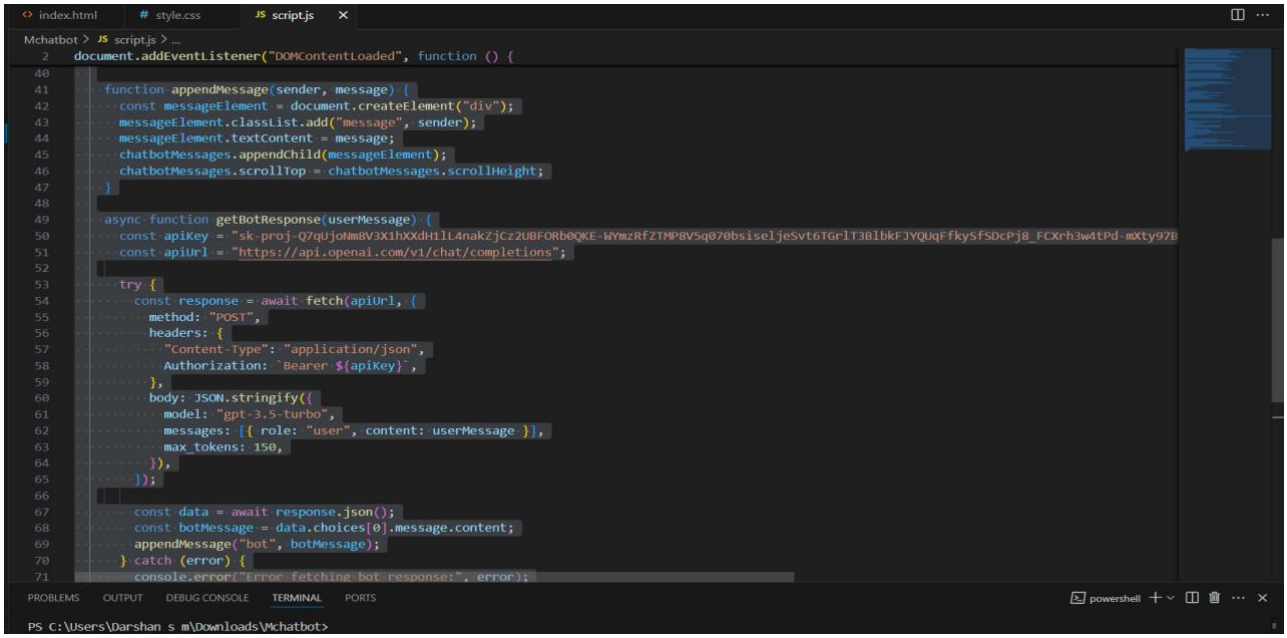

Figure 9.3 : JavaScript

JavaScript is also key in making the chatbot interactive and operational. It manages user interactions like opening the chat window when "Start Chatting" is clicked, revealing the profile dropdown menu, and toggling between the signup and login forms. The signup and login functionalities are tied to Firebase for backend authentication via email or phone number to secure access to the chatbot. JavaScript also updates the chat interface dynamically, sending user queries and retrieving responses, mimicking an actual real-time conversational experience. Error handling and input checks are used to avoid invalid data and provide seamless form submissions.

JavaScript is a powerful and versatile programming language employed mainly to develop dynamic and interactive web content. JavaScript is a client-side scripting language, which executes inside the user's browser, not on the server. JavaScript gives the developers the feature of adding advanced functionalities like live updates, dynamic forms, animation, and capability to modify the page content without requesting the page reload. For instance, JavaScript makes it possible to have events like handling user clicks, form input validation, or asynchronously loading new data from a server, all of which work towards improving the user experience on websites.

Integration and User Experience

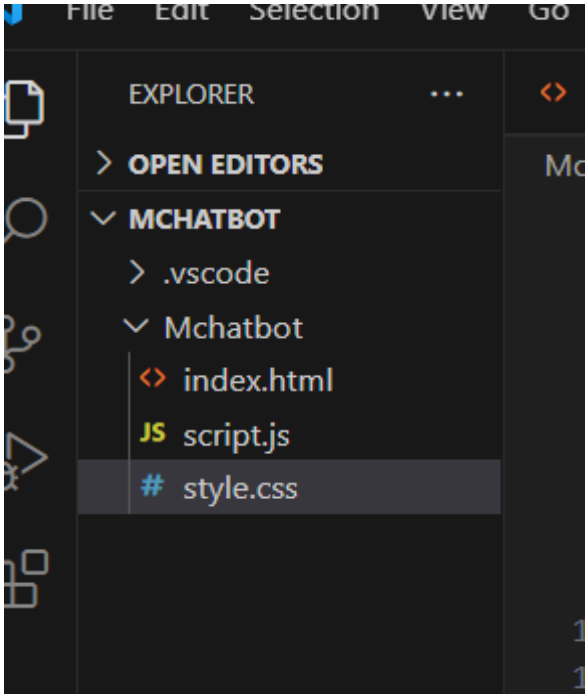

Figure 9.4 : Folder

The integration of HTML, CSS, and JavaScript is seamless, resulting in a cohesive and interactive web application. Firebase integration ensures reliable backend support for authentication, while the frontend provides a user-centric design that is easy to navigate. The chatbot responds promptly to queries, enhancing user satisfaction. The interface encourages users to engage further with its clean design and responsive controls.

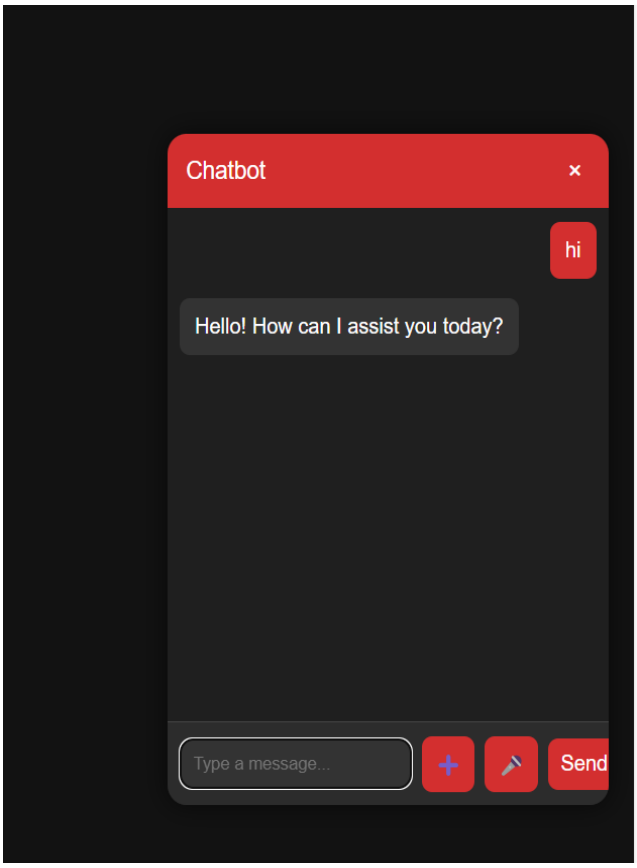

Figure 9.5: Result1

HTML is at the base level of arranging the layout and the elements of the UI of the chatbot. HTML gives the structure which supports the most important elements like the chatbot's icon, the message wrapper, text input field, and close. The icon for the chatbot resides in the same place on the bottom-right corner of the screen at all times, and this positions the chatbot easily within reach of the users at all times without interfering with the main content. When clicked upon, it opens the `#chatbot-container` inside which the whole interface resides. This setup allows the chatbot's interface to be simple to use, simple to get around, and easily accessible even to the least technologically savvy users. Also, the layout is made responsive to accommodate any size of the device, and this is an utmost priority when building a responsive and user-friendly experience. Also, by creating the page modularity, it makes the HTML code easy in terms of modification and scaling at a later stage, hence being versatile for a variety of uses and design necessities.

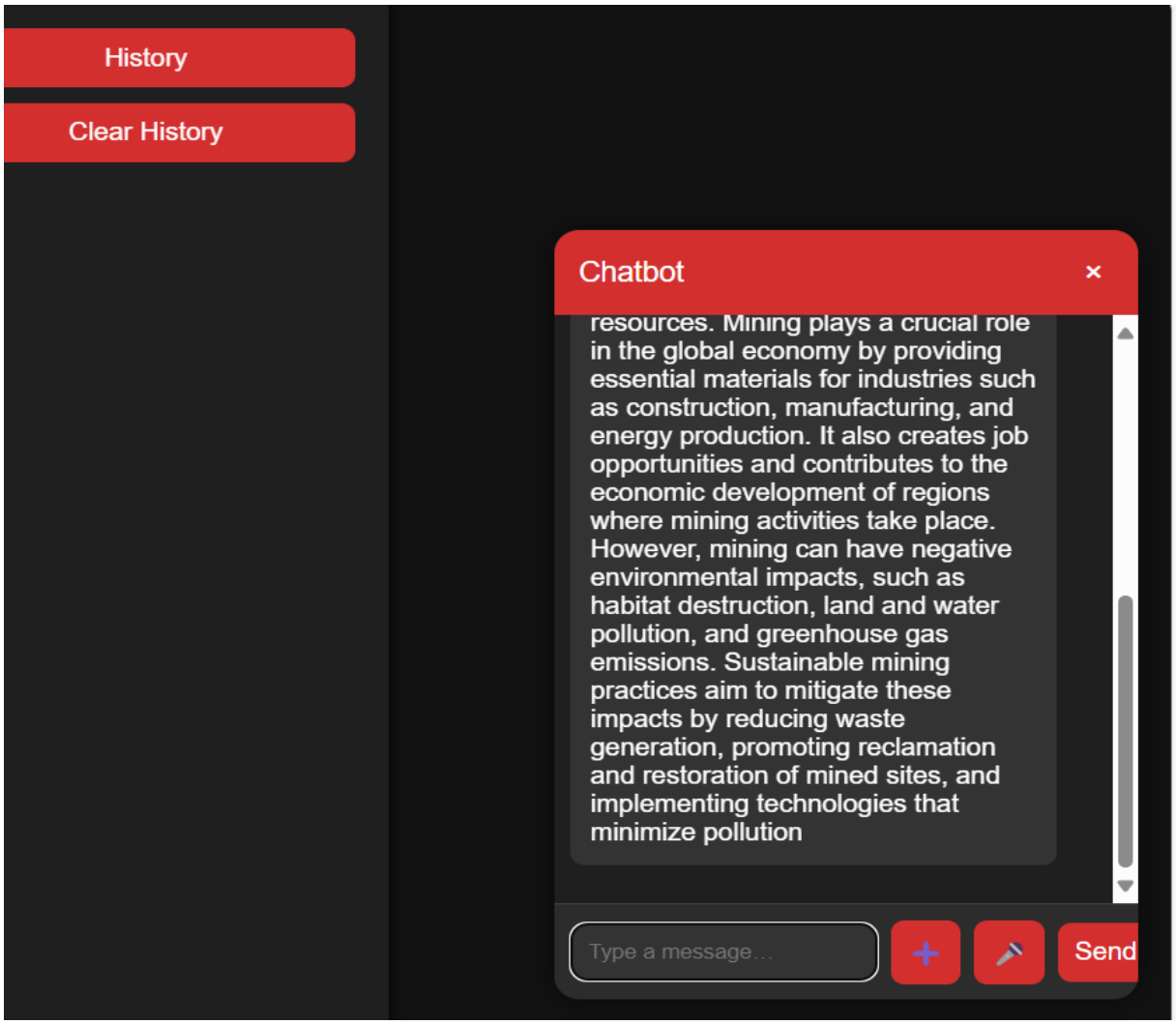

Figure 9.6: Result2

JavaScript is the foundation of chatbot behavior, controlling interactivity and facilitating user and OpenAI API interaction. Opening and closing of chatbot interface through user interaction with the close button and the chatbot icon are operated through JavaScript code. Clicking on the chatbot icon triggers opening up of the chatbot container, and the close button triggers closing up of the chatbot container. This mechanism of interaction offers easy access to the chatbot without encroaching into other web page information.

Where the user input must be processed, JavaScript responds when the "Send" button is clicked or the "Enter" key is pressed, and sending of the messages begins. Once a message has been sent, the JavaScript program checks if the input field is empty, puts the user's message within the messages container, and clears the input field in anticipation of sending the next message. The

process is squarely crucial in facilitating a smooth exchange of communication. After the user's message is posted, JavaScript interacts with the OpenAI API, posting the user's message and then receiving a response from the AI model. The response is posted as a bot message within the conversation.

One of the most important advantages of the JavaScript solution is the use of the `fetch` API to enable asynchronous communication with the OpenAI API. By including a POST request with the user's query, JavaScript can retrieve a real-time response and print it to the user in real time. This provides an uninterrupted chat experience, with the chatbot responding naturally. Error handling is also implemented in the system, and therefore the chatbot can recover effectively from errors like APIs, displaying a default error message where necessary. CSS is an essential part of the aesthetic appeal and accessibility of the chatbot interface.
The floating icon of the chatbot has been styled to resemble a round button in a red color scheme, hence is both attractive and readily identifiable. The effect of hover, where the size of the icon is marginally enlarged and the color changed, creates a perception of interactivity, providing instantaneous feedback to the user and a dynamic and responsive nature to the interface. Fixed positioning fixes the icon in place on the screen regardless of any scrolling that may happen, where it is always visible. The main chatbot container is constructed using a dark color scheme, for example, an instance of dark gray background and rounded corners, and a faint shadowing effect.

Such graphical ones create a clean, modern look that suits modern web design. User input and the bot's response appear in distinct colored message bubbles which tell the user what they have input and what the bot is responding with. The message bubbles also receive appropriate padding and rounded edges, making it look neat professional. In addition to this, the input field is also made user-friendly with the send button and text input field clearly visible and at hand. The send button is red bordered, just like the rest of the color scheme, and its color is altered on hover, again establishing the interactivity of the chatbot. All these aspects of CSS make the chatbot a desirable, smooth to use interface that gives the best user experience.

CHAPTER-10
CONCLUSION

In conclusion, Simply, the chatbot system used herein is a functional way of handling users in light of talking about mining industry regulation. With the application of artificial intelligence technologies such as the OpenAI API, the chatbot is able to respond instantly, accurately, and contextually to different user inquiries. While the current implementation is simple, it provides a good foundation for further development of more sophisticated systems that can assist users in regulatory compliance activities and facilitate legal information access. As the system matures, further features can be added to make it increasingly user-friendly, functional, and useful to the mining industry. the chatbot built in this code is a good tool for user interaction in the context of regulating the mining industry. Using AI technologies such as the OpenAI API, the chatbot can provide instant, accurate, and contextually sensitive responses to highly varied user queries. While the current implementation is quite simple, it provides a solid foundation for more sophisticated systems that can assist users with regulatory compliance processes and improving legal information access. Once the system evolves further, more functionality can be added to help improve its capabilities.

The "chatbot" initiative is an abomination move towards the digitalization of the mining industry by a smart, friendly chatbot platform to ease professionals, regulators, and others interested in them. The web app offline chatbot as low-key, friendly interface and high-level backend integration is a move towards bridging the gap between the user and the advanced regulation system that operates mining activities smoothly. With the use of technologies like HTML, CSS, and JavaScript on the client side, and Firebase to provide secure authentication and real-time database, Mchatbot provides security with convenience of data. Convenience is provided by the availability of login and signup through email and phone authentication and secure access to personalized features. The chatbot itself is also trained to recognize user queries regarding mining acts, rules, and regulations and offer instant and accurate answers based on pre-trained or fine-tuned natural language models.
Apart from the fact that there is an innovative welcome page with navigation features, like a responsive profile menu, that adds to the value of the user interaction experience, the user interface is made to be both visually appealing and functionally efficient, and therefore users find it easy to transition from introduction to interaction

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APPENDIX-A

PSUEDOCODE

Html Code

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Chatbot</title>
   <link rel="stylesheet" href="style.css">
</head>
<body>
   <div id="chatbot-icon">🤖</div>
   <div id="chatbot-container" class="hidden">
      <div id="chatbot-header">
         <span>Chatbot</span>
         <button id="close-btn">&times;</button>
      </div>
      <div id="chatbot-body">
         <div id="chatbot-messages"></div>
      </div>
      <div id="chatbot-input-container">
         <input type="text" id="chatbot-input" placeholder="Type a message.....">
         <button id="send-btn">Send</button>
      </div>
   </div>
   <script src="script.js"></script>
</body>
</html>
```

Java Script Code

```
// script.js
document.addEventListener("DOMContentLoaded", function () {
    const chatbotContainer = document.getElementById("chatbot-container");
    const closeBtn = document.getElementById("close-btn");
    const sendBtn = document.getElementById("send-btn");
    const chatbotInput = document.getElementById("chatbot-input");
    const chatbotMessages = document.getElementById("chatbot-messages");

    const chatbotIcon = document.getElementById("chatbot-icon");
    const closeButton = document.getElementById("close-btn");

    // Toggle chatbot visibility when clicking the icon
    // Show chatbot when clicking the icon
    chatbotIcon.addEventListener("click", function () {
      chatbotContainer.classList.remove("hidden");
      chatbotIcon.style.display = "none"; // Hide chat icon
    });

    // Also toggle when clicking the close button
    closeButton.addEventListener("click", function () {
      chatbotContainer.classList.add("hidden");
      chatbotIcon.style.display = "flex"; // Show chat icon again
    });

    sendBtn.addEventListener("click", sendMessage);
    chatbotInput.addEventListener("keypress", function (e) {
      if (e.key === "Enter") {
        sendMessage();
      }
    });

    function sendMessage() {
      const userMessage = chatbotInput.value.trim();
      if (userMessage) {
        appendMessage("user", userMessage);
        chatbotInput.value = "";
        getBotResponse(userMessage);
      }
    }

    function appendMessage(sender, message) {
      const messageElement = document.createElement("div");
```

```
    messageElement.classList.add("message", sender);
    messageElement.textContent = message;
    chatbotMessages.appendChild(messageElement);
    chatbotMessages.scrollTop = chatbotMessages.scrollHeight;
  }

  async function getBotResponse(userMessage) {
        const apiKey = "sk-proj-Q7qUjoNm8V3X1hXXdH1lL4nakZjCz2UBFORb0QKE-
WYmzRfZTMP8V5q070bsiseljeSvt6TGrlT3BlbkFJYQUqFfkySfSDcPj8_FCXrh3w4tPd-
mXty97BZitksPXBgwwbbmwQhCh1J8ti8-TEIEvYbphfAA"; // Replace with your OpenAI API key
    const apiUrl = "https://api.openai.com/v1/chat/completions";

    try {
      const response = await fetch(apiUrl, {
        method: "POST",
        headers: {
          "Content-Type": "application/json",
          Authorization: `Bearer ${apiKey}`,
        },
        body: JSON.stringify({
          model: "gpt-3.5-turbo",
          messages: [{ role: "user", content: userMessage }],
          max_tokens: 150,
        }),
      });

      const data = await response.json();
      const botMessage = data.choices[0].message.content;
      appendMessage("bot", botMessage);
    } catch (error) {
      console.error("Error fetching bot response:", error);
      appendMessage("bot", "Sorry, something went wrong. Please try again.");
    }
  }
});
```

Style.css

```
/* General Styles */
body {
    font-family: Arial, sans-serif;
    background-color: #121212;
    margin: 0;
    padding: 0;
    color: #fff;
  }

  /* Floating Chat Icon */
  #chatbot-icon {
    position: fixed;
    bottom: 20px;
    right: 20px;
    width: 60px;
    height: 60px;
    background-color: #d32f2f;
    color: white;
    font-size: 30px;
    display: flex;
    justify-content: center;
    align-items: center;
    border-radius: 50%;
    box-shadow: 0 0 15px rgba(0, 0, 0, 0.4);
    cursor: pointer;
    transition: transform 0.2s, background-color 0.2s;
  }

  #chatbot-icon:hover {
    background-color: #b71c1c;
    transform: scale(1.1);
  }

  /* Chatbot Container */
  #chatbot-container {
    position: fixed;
    bottom: 80px;
    right: 20px;
    width: 350px;
    height: 450px;
    background-color: #1f1f1f;
    border-radius: 15px;
```

```
  box-shadow: 0 0 20px rgba(0, 0, 0, 0.6);
  display: flex;
  flex-direction: column;
  overflow: hidden;
}

/* Hide Chatbot Initially */
.hidden {
  display: none !important;
}

/* Chatbot Header */
#chatbot-header {
  background-color: #d32f2f;
  color: white;
  padding: 15px;
  border-top-left-radius: 15px;
  border-top-right-radius: 15px;
  display: flex;
  justify-content: space-between;
  align-items: center;
  font-size: 18px;
}

#close-btn {
  background: none;
  border: none;
  color: white;
  font-size: 20px;
  cursor: pointer;
}

/* Chatbot Body */
#chatbot-body {
  flex: 1;
  padding: 10px;
  overflow-y: auto;
}

/* Chatbot Messages */
#chatbot-messages {
  display: flex;
  flex-direction: column;
}
```

```
.message {
  margin-bottom: 15px;
  padding: 12px;
  border-radius: 8px;
  max-width: 85%;
}

.message.user {
  background-color: #d32f2f;
  color: white;
  align-self: flex-end;
}

.message.bot {
  background-color: #333;
  color: white;
  align-self: flex-start;
}

/* Input Section */
#chatbot-input-container {
  display: flex;
  padding: 10px;
  border-top: 1px solid #444;
  background-color: #2c2c2c;
}

#chatbot-input {
  flex: 1;
  padding: 10px;
  border: 1px solid #444;
  border-radius: 10px;
  background-color: #333;
  color: white;
}

#send-btn {
  margin-left: 10px;
  padding: 10px 15px;
  background-color: #d32f2f;
  color: white;
  border: none;
  border-radius: 8px;
```

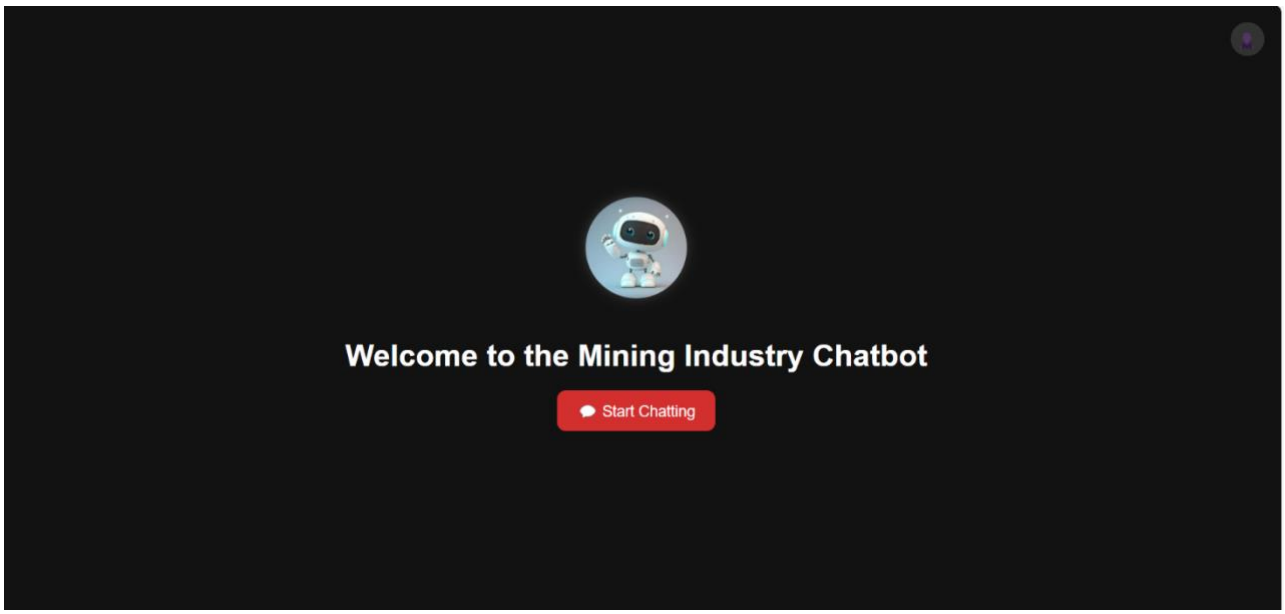
```
  cursor: pointer;
  font-size: 16px;
}

#send-btn:hover {
  background-color: #b71c1c;
}
```

APPENDIX-B

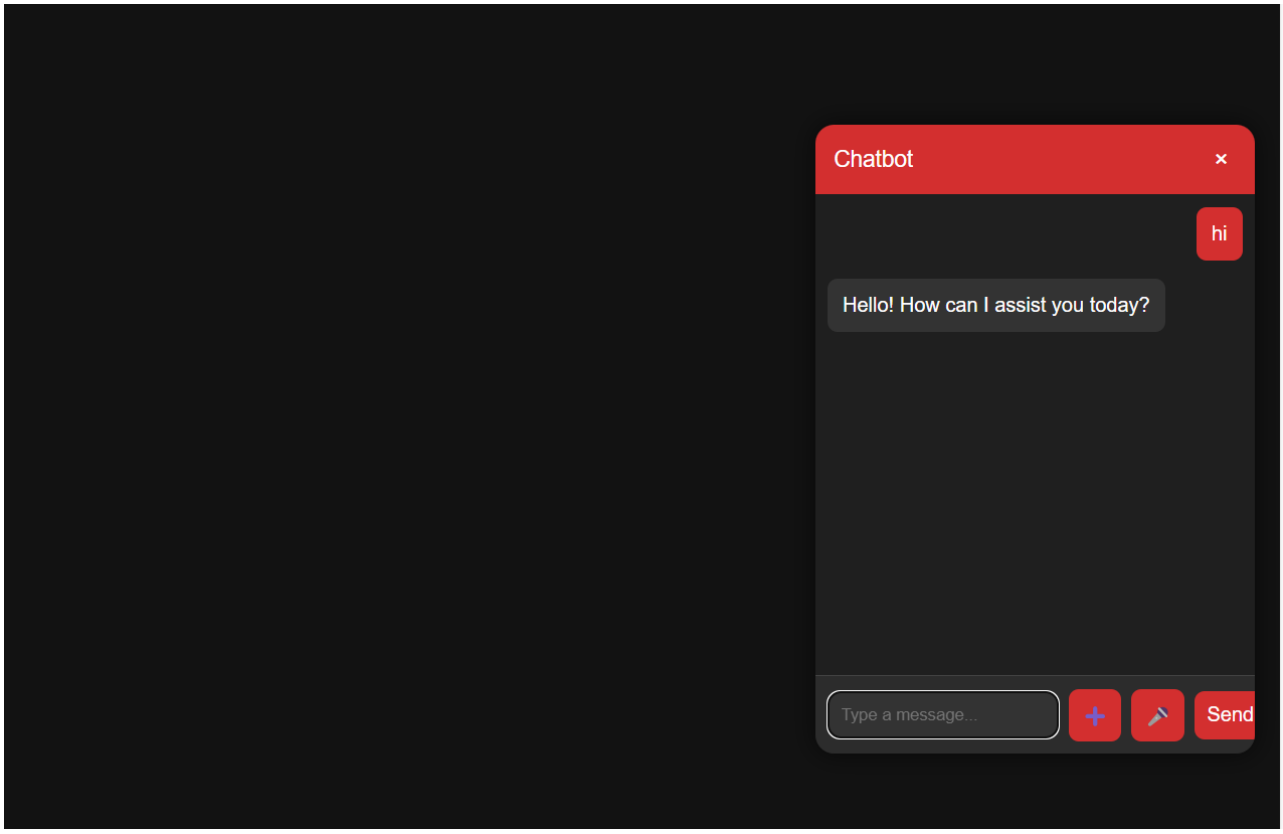
SCREENSHOTS

Welcome Page

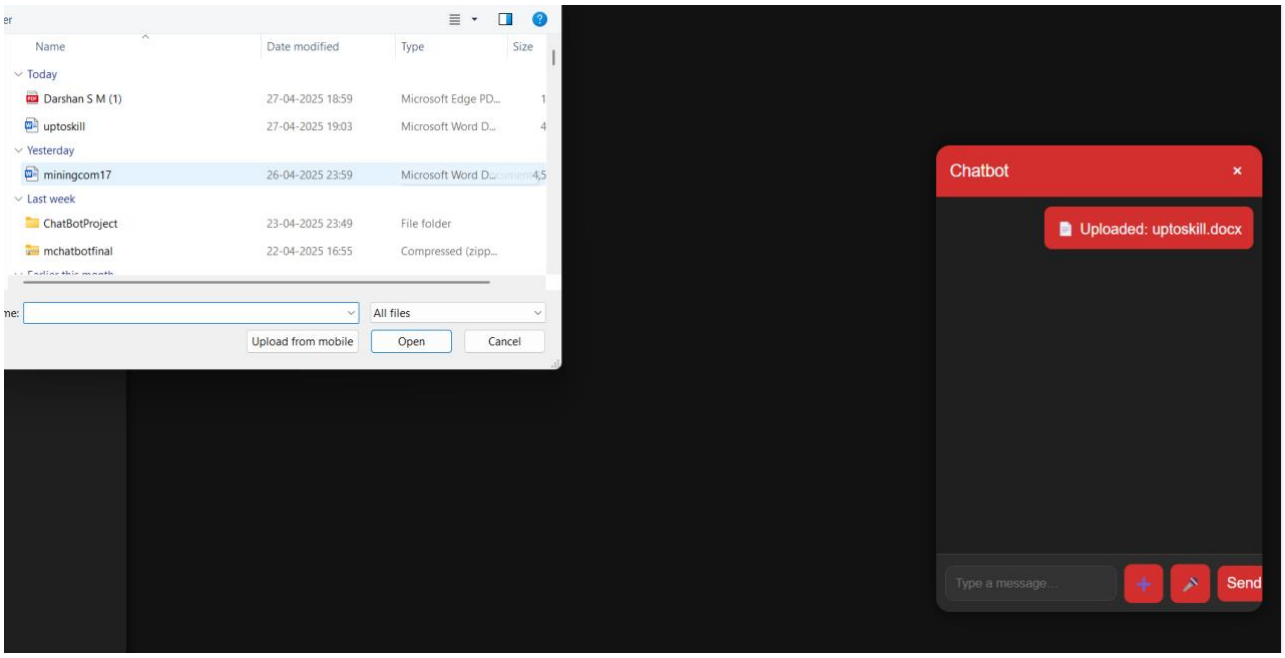


ChatBot Page

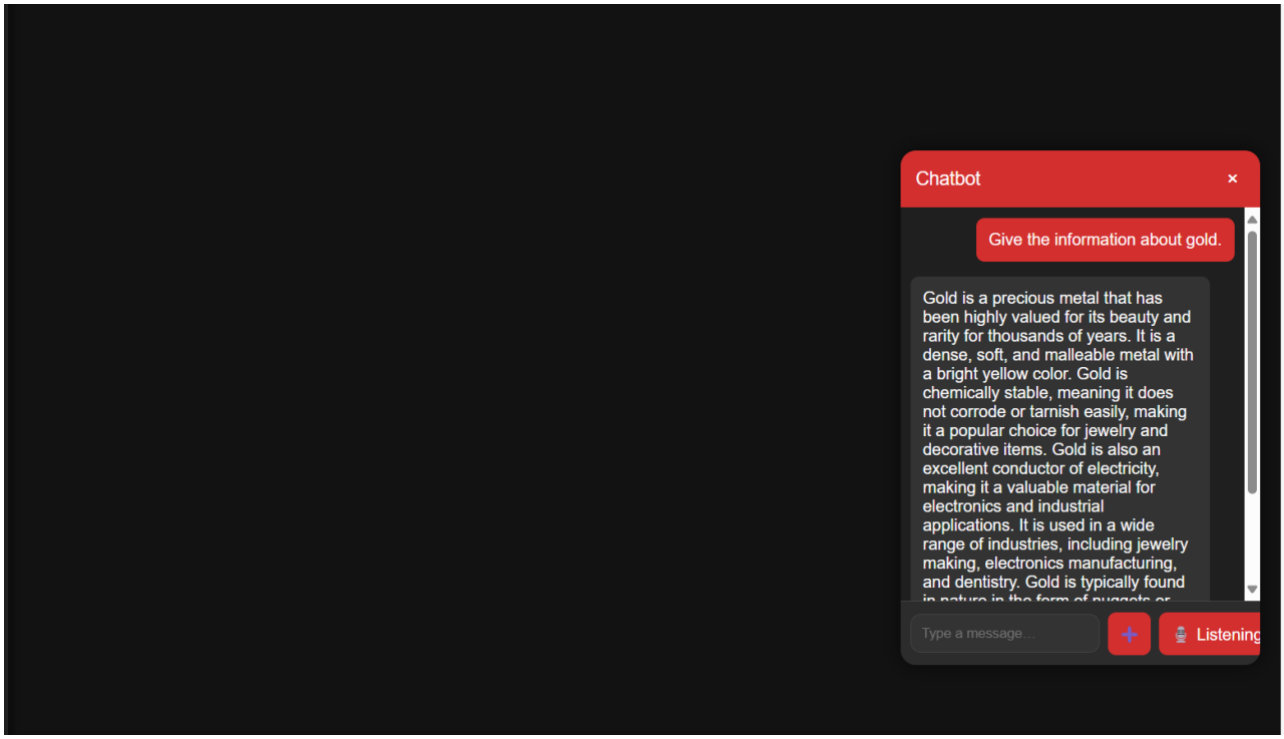
ChatBot Window



File Upload Page

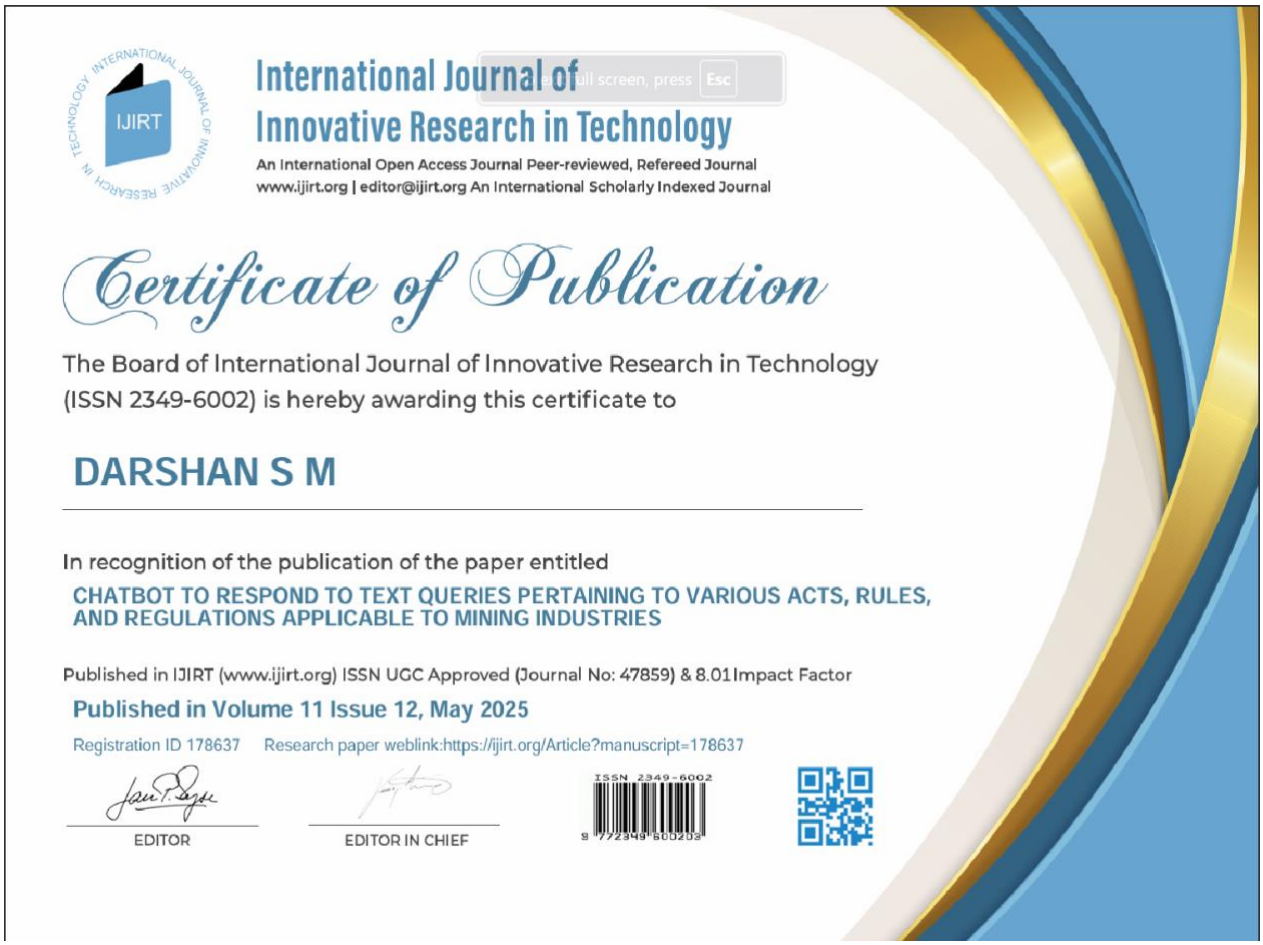


Voice Message Page



APPENDIX-C
ENCLOSURES

1.Journal Publication/Conference Paper Presented Certificates of all Student



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Published in Volume 11 Issue 12, May 2025

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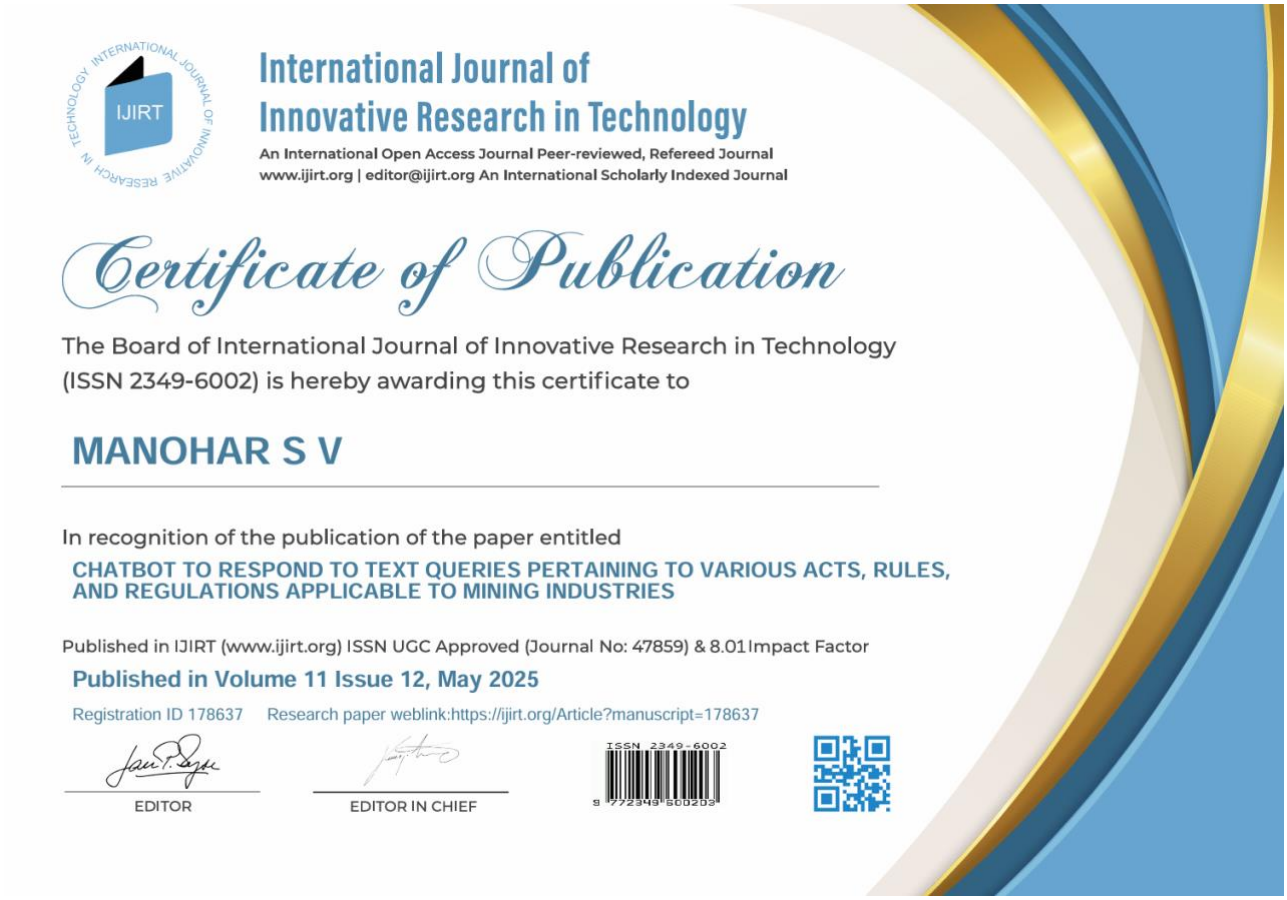

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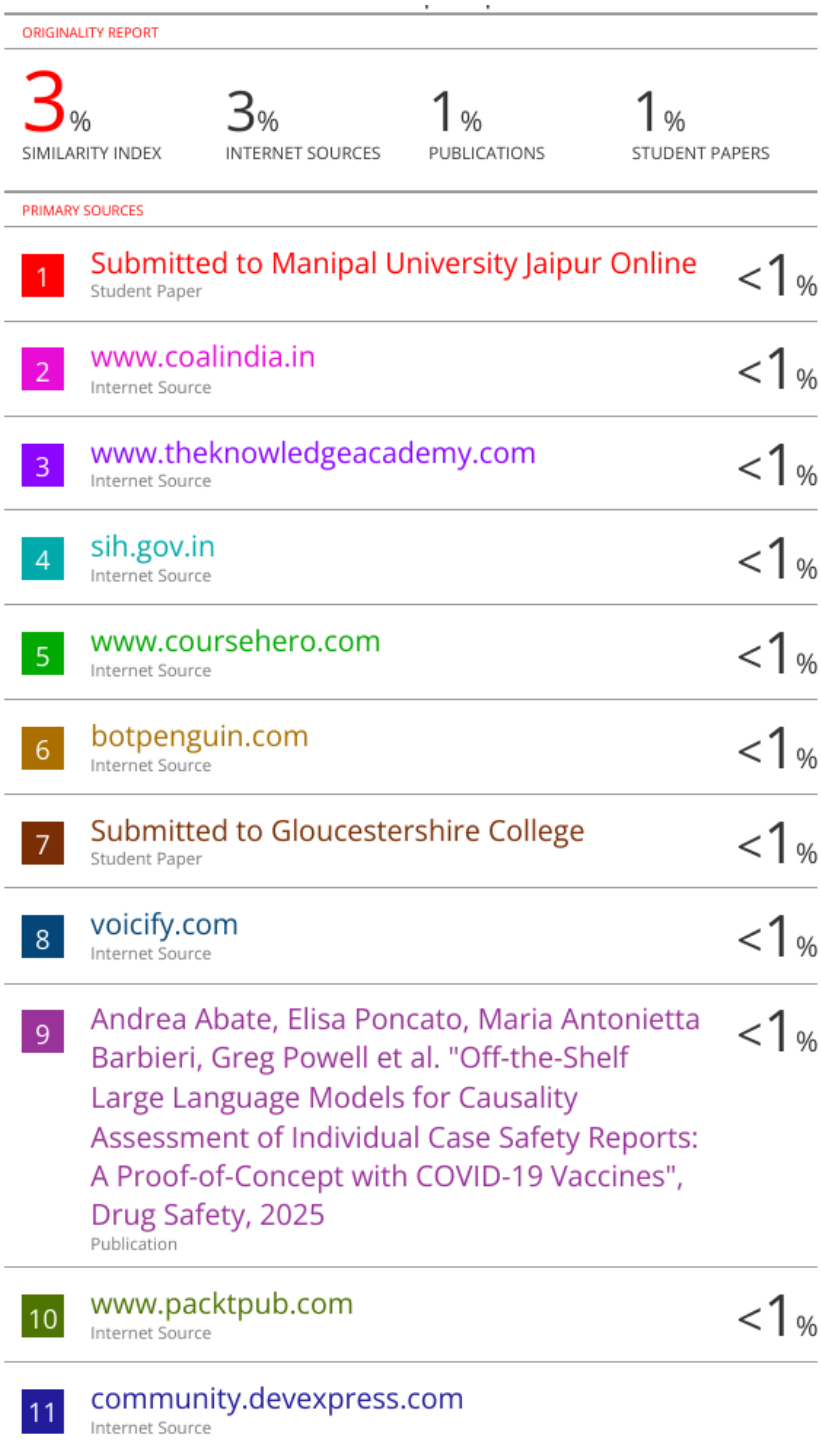
2.Similarity Index/Plagiarism Check Report Clearly Showing the percentage (%)



ORIGINALITY REPORT

3%	3%	1%	1%
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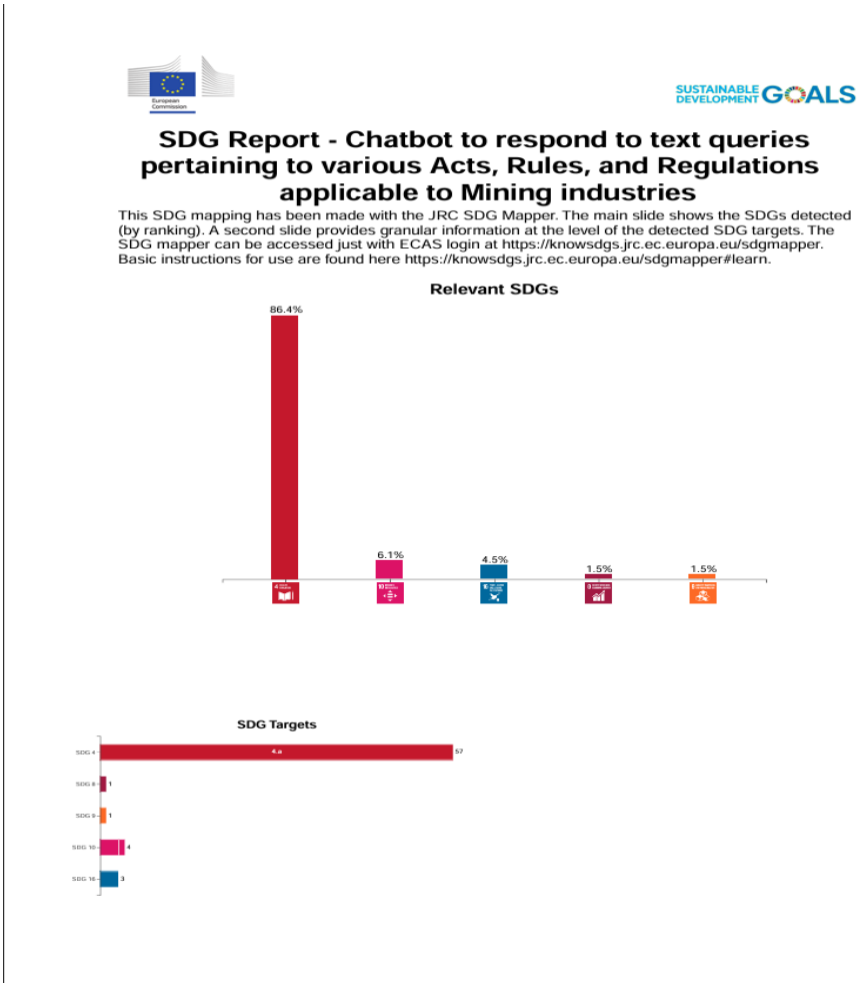
11	community.devexpress.com Internet Source	

3. Details of mapping the project with the Sustainable development Goals (SDGs)



"SDG Report - Chatbot to respond to text queries pertaining to various Acts, Rules, and Regulations applicable to Mining industries" outlines the alignment of a chatbot project with the United Nations Sustainable Development Goals (SDGs). The key points of the report are:

Purpose: The project involves a chatbot designed to answer queries related to legal and regulatory frameworks in the mining sector.

Tool Used: The SDG mapping was performed using the JRC SDG Mapper, accessible to users with an ECAS login.

SDG Relevance: The chatbot is shown to be most relevant to the following SDGs, with the percentages indicating the strength of alignment:

SDG 4 (Quality Education) – 86.4%

SDG 8 (Decent Work and Economic Growth) – 6.1%

SDG 9 (Industry, Innovation, and Infrastructure) – 4.5%

SDG 10 (Reduced Inequalities) – 1.5%

SDG 16 (Peace, Justice and Strong Institutions) – 1.5%

Detailed SDG Targets: The report includes a breakdown by SDG targets, such as 4.a (effective learning environments), indicating the chatbot supports educational and legal awareness goals.

Overall, the chatbot contributes significantly to education and access to legal knowledge within the mining industry, while also supporting governance, economic, and industrial innovation objectives in a minor but relevant way.