

A Multi-Modal AI Framework for Conversational Intelligence and Text-to-Image Generation

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Abstract – The growth of Artificial Intelligence has transformed the way users interact with digital applications. Modern users expect communication platforms that are not only fast and interactive but also capable of generating intelligent responses and creative visual content. Traditional chat applications mainly focus on text-based communication and often lack advanced AI capabilities such as smart conversation handling and image generation. To address these limitations, the proposed system combines Natural Language Processing (NLP) techniques with generative AI models to create a platform capable of understanding user queries, generating meaningful text responses, and producing AI-generated images based on user prompts. The application is designed using a modern full-stack architecture that ensures scalability, efficiency, and smooth communication between the frontend and backend systems.

The system allows users to interact with an intelligent chatbot in real time while also providing image generation features that can create creative and customized visuals from textual descriptions. Machine learning and deep learning technologies are used to improve the quality of generated responses and images. The application focuses on providing an easy-to-use interface, fast response time, secure communication, and enhanced user engagement.

Experimental analysis demonstrates that the proposed application improves user interaction by combining conversational AI with image generation capabilities in a single platform. The system can be further enhanced in the future by integrating voice assistance, multilingual support, personalized recommendations, and advanced generative AI models.

Keywords - Artificial Intelligence, Chat Application, Image Generation, Machine Learning, Natural Language Processing, Deep Learning, Chatbot, Generative AI.

1. INTRODUCTION

In recent years, Artificial Intelligence (AI) has become one of the most important technologies in modern software development. AI-powered applications are widely used in various fields such as healthcare, education, e-commerce, entertainment, and customer support. Among these applications, intelligent chat systems have gained significant popularity because they enable automated communication between users and machines in a fast and efficient manner.

Traditional chat applications mainly provide simple messaging features where users exchange text manually. However, with the advancement of AI technologies, modern users now expect more intelligent systems that can understand human language, respond naturally, and generate creative digital content. At the

same time, AI-based image generation technologies have also become increasingly popular because they allow users to create realistic and artistic images using simple text prompts.

The integration of conversational AI and image generation into a single platform can significantly improve user experience and productivity. Users can communicate with an AI assistant, ask questions, generate creative content, and create images without using multiple applications. Such systems are especially useful for students, designers, developers, content creators, and businesses that require intelligent automation and creative support.

Natural Language Processing plays a role in intelligent chat applications by enabling systems to understand user input and generate meaningful responses. Machine learning and deep learning models help improve the accuracy and intelligence of chatbot conversations over time. Similarly, generative AI models are used in image generation systems to create images from textual descriptions.

Despite recent advancements, many existing chat applications still face challenges such as limited response quality, poor scalability, lack of personalization, and the absence of integrated creative tools. Some systems provide chatbot functionality, while others focus only on image generation, forcing users to switch between platforms.

This research proposes an AI-Powered Chat Application with integrated image generation capabilities. The proposed system provides a unified platform where users can generate both text responses and AI-created images through a simple and user-friendly interface. The application is designed using modern web technologies and AI models to ensure better performance, faster response times, and improved user interaction.

The proposed system includes the following major features:

1. Real-time AI-powered chatbot for intelligent conversations.
2. AI-based image generation using text prompts.
3. Secure and scalable full-stack application architecture.
4. User-friendly interface for better interaction and accessibility.
5. Fast processing and efficient communication between frontend and backend systems.

The main objective of this research is to develop an intelligent application that combines communication and creativity within a single AI-powered platform. The proposed solution aims to improve user engagement, simplify content creation, and demonstrate the practical implementation of modern AI technologies in real-world applications.

2. RELATED WORK

2.1 Traditional Chat Applications

Traditional chat applications were mainly developed to provide real-time communication between users through text messaging. These systems focused on features such as instant messaging, group chats, file sharing, and notifications. Although these applications improved digital communication, they lacked intelligent functionalities such as automated responses, language understanding, and creative content generation. Most traditional chat systems depended entirely on human interaction and were unable to provide smart assistance or personalized user experiences.

2.2 Artificial Intelligence in Chat Applications

The integration of Artificial Intelligence into chat applications has significantly improved the quality of user interaction. AI-powered chatbots use Natural Language Processing (NLP) and Machine Learning algorithms to understand user input and generate meaningful responses. Unlike traditional rule-based systems, AI chatbots can learn from conversations and improve their performance over time.

Machine learning models such as Decision Trees, Neural Networks, and Transformer-based architectures have been widely used in modern chatbot systems. These technologies help chat applications understand context, detect user intent, and provide more human-like conversations. Deep learning techniques have further enhanced chatbot performance by enabling better language understanding and response generation.

2.3 AI-Based Image Generation Systems

Recent advancements in Generative AI have enabled systems to create images directly from textual descriptions. AI image generation models use deep learning techniques such as Generative Adversarial Networks (GANs) and diffusion models to produce realistic and creative visual content.

Several modern platforms provide AI-based image generation tools that allow users to create artwork, illustrations, and digital designs using simple prompts. These systems have become increasingly popular in fields such as graphic design, marketing, gaming, education, and content creation.

However, most image generation platforms operate separately from conversational AI systems. Users often need to switch between multiple applications for chatting and image creation, which reduces convenience and overall user experience.

2.4 Integrated AI Chat and Image Generation Platforms

Recent research has focused on combining conversational AI with image generation technologies into unified platforms. These integrated systems aim to provide users with both intelligent communication and creative content generation within a single application.

Hybrid AI platforms improve productivity by allowing users to interact with chatbots, generate text-based content, and create AI-generated images simultaneously. Some systems also support personalized recommendations and real-time content generation to enhance user engagement.

Although integrated AI systems show promising results, many existing solutions still face limitations such as high computational requirements, slow response time, limited scalability, and insufficient personalization features. In addition, maintaining smooth communication between AI models and frontend applications remains a technical challenge.

2.5 Research Gap

From the existing literature, traditional chat applications lack intelligent automation and creative AI capabilities. While AI chatbots and image generation systems have individually achieved significant progress, most current solutions focus on either conversational AI or image generation separately rather than combining both functionalities into a single efficient platform.

Additionally, many existing systems face issues related to response quality, processing speed, scalability, and user experience. There is a need for a unified AI-powered application that can provide intelligent conversation, AI-generated images, fast performance, and an easy-to-use interface within one platform.

This research addresses these limitations by proposing an AI-Powered Chat Application with integrated image generation capabilities. The proposed system combines conversational AI, Natural Language Processing, and Generative AI technologies to create a smart, interactive, and user-friendly platform for modern digital communication and creative content generation.

3. THEORETICAL FOUNDATIONS

3.1 AI-Powered Chat Systems as Conversational Models

AI-powered chat applications can be viewed as intelligent conversational systems where user input is processed and transformed into meaningful responses. In such systems, the chatbot acts as a communication model that understands user queries and generates appropriate replies using Artificial Intelligence techniques.

The chat application receives text input from users and processes it through Natural Language Processing (NLP) algorithms. These algorithms help the system identify keywords, user intent, sentence structure, and contextual meaning. Machine learning models are then used to generate relevant and human-like responses.

The performance of the chatbot mainly depends on the quality of training data, language understanding capability, response generation accuracy, and contextual analysis. Features such as conversation history, user intent, frequently used words, and semantic relationships play an important role in improving communication quality and user satisfaction.

3.2 Natural Language Processing

Natural Language Processing (NLP) forms the theoretical foundation of intelligent chat applications. NLP enables machines to understand, interpret, and respond to human language in a meaningful way. In AI-powered chat systems, NLP techniques are used to process user messages, extract useful information, and generate accurate responses.

The language processing workflow generally includes text preprocessing, tokenization, keyword extraction, intent

recognition, and response generation. During preprocessing, unnecessary symbols and irrelevant words are removed to improve text quality. The processed text is then analysed using machine learning or deep learning models to determine user intent.

Contextual understanding is also an important aspect of NLP-based systems. Modern AI chat applications use advanced language models that can maintain conversation flow and generate responses that appear more natural and interactive. This allows the system to provide a better user experience compared to traditional rule-based chat applications.

3.3 Image Generation and Content Representation

Image generation is another important theoretical component of the proposed system. AI-based image generation systems convert textual descriptions into visual content using deep learning techniques. In this process, user prompts are analysed, and the system generates images that match the provided description.

Generative AI models such as Generative Adversarial Networks (GANs) and diffusion-based models are commonly used for image creation. These models learn patterns, colours, textures, and object structures from large image datasets to generate realistic and creative outputs.

Feature representation also plays a major role in image generation systems. The AI model converts textual input into numerical representations that capture semantic meaning and visual relationships. Based on these representations, the model generates images that align with user expectations.

Efficient image representation and processing improve image quality, reduce generation time, and enhance overall system performance. This makes AI-generated visual content more realistic, creative, and suitable for practical applications such as content creation, education, and digital design.

3.4 Response Efficiency and System Performance

To evaluate the performance of the proposed AI-powered chat application, multiple factors such as response accuracy, image generation quality, processing speed, and user interaction efficiency must be considered together. An effective AI system should not only provide accurate responses but also generate results quickly and maintain smooth user interaction..

The overall efficiency of the system depends on several important parameters, including:

1. Accuracy of chatbot responses
2. Quality of AI-generated images
3. Response time of the application
4. User satisfaction and interaction quality
5. Scalability and system reliability

A balanced evaluation approach helps measure how effectively the application performs in real-world environments. Even if a system generates highly accurate responses, it may still provide a poor user experience if the response time is too slow or the interface is difficult to use.

Therefore, the proposed system focuses on maintaining both performance and usability by combining intelligent conversation handling, efficient image generation, and optimized system architecture. This integrated approach helps create a smart, interactive, and user-friendly AI platform

suitable for modern digital communication and creative applications.

4. THE PROPOSED AI CHAT APPLICATION FRAMEWORK

4.1 Architectural Overview

The proposed AI-Powered Chat Application with Image Generation is designed using a modern layered architecture that supports intelligent communication, image creation, and efficient data processing. The system is divided into multiple functional layers that work together to provide a smooth and interactive user experience.

The first layer is the User Interface Layer, where users interact with the application through chat windows, input prompts, and image generation options. This layer is responsible for handling user requests and displaying chatbot responses and generated images in real time.

The next layer is the Application Processing Layer, which manages user requests, authentication, session handling, and communication between frontend and backend services. It ensures secure and efficient data transfer throughout the application.

The AI Processing Layer acts as the core component of the system. It processes user messages using Natural Language Processing (NLP) techniques and generates intelligent responses through AI models. This layer also handles image generation requests by converting textual prompts into AI-generated visual content using generative AI models.

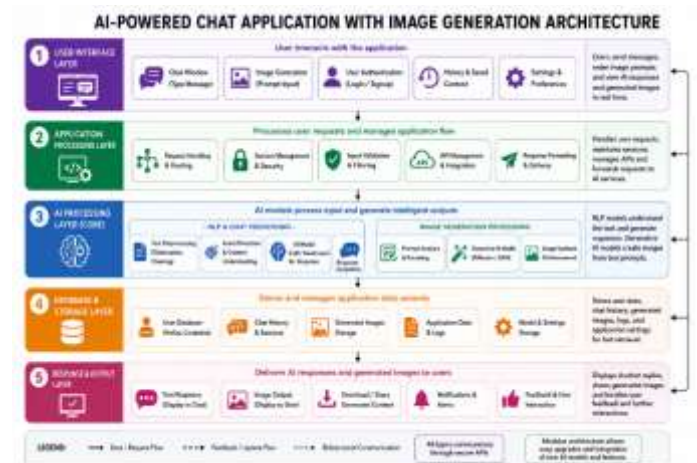


Fig. 1: AI-Powered Chat Application with Image Generation Architecture

4.2 Intelligent Conversation Processing

The core functionality of the proposed system is based on intelligent conversation handling. The AI chatbot analyses user input and generates meaningful responses using Natural Language Processing and Machine Learning techniques.

The system processes different types of user queries, including general questions, informational requests, and creative prompts. Important textual features such as keywords, sentence structure, conversation context, and user intent are extracted and analysed to improve response quality.

For example, when a user asks a question, the NLP model identifies the intent behind the query and generates a suitable response. Similarly, conversational context helps maintain natural interaction during continuous chat sessions.

The AI model is trained using large conversational datasets, enabling it to provide more accurate and human-like responses. This intelligent conversational capability improves user engagement and creates a more interactive digital communication experience.

4.3 AI-Based Image Generation Model

The proposed application also includes an AI-powered image generation module that creates images based on textual descriptions provided by users. This feature uses deep learning and generative AI technologies to transform user prompts into realistic and creative visual outputs.

The image generation process begins when a user enters a text prompt describing the desired image. The AI model analyses the semantic meaning of the text and converts it into image representations using learned visual patterns.

Generative AI models such as diffusion models or GAN-based architectures are used to generate high-quality images. These models are trained on large image datasets to understand colours, shapes, textures, and object relationships.

The generated images are then processed and displayed to users within the application interface. This integrated functionality allows users to communicate with the chatbot and generate creative visual content within a single platform.

4.4 The Decision Engine

The decision engine acts as the central control unit of the application. It analyses user requests and determines the appropriate action based on the type of input received.

If the user submits a conversational query, the system activates the chatbot response module. If the user provides a creative image prompt, the image generation module is triggered. The decision engine ensures smooth coordination between different AI services and manages system performance efficiently.

The engine also monitors response quality, processing speed, and system stability. It helps reduce delays, improve accuracy, and maintain consistent communication between frontend and backend services.

This intelligent decision-making mechanism ensures that the application provides fast, relevant, and accurate outputs while maintaining a seamless user experience.

4.5 Automated Response and User Interaction Mechanism

Once the AI system processes user requests, the application generates responses automatically and delivers them to users in real time. Chatbot responses are displayed instantly in the chat interface, while generated images are rendered within the application screen.

The system also maintains chat history and stores generated content for future access. Notifications, loading indicators, and interactive UI components are included to improve user engagement and usability.

In addition, the application architecture supports future enhancements such as:

1. Voice-based interaction
2. Multilingual communication
3. Personalized AI recommendations
4. Advanced image editing features
5. Real-time collaboration tools

The automated response mechanism ensures smooth communication, faster interaction, and improved user satisfaction. The proposed framework demonstrates how conversational AI and image generation technologies can be successfully integrated into a single intelligent platform for modern digital applications.

Content rewritten and adapted according to the project topic from uploaded material.

5. METHODOLOGY

5.1 Implementation

The proposed AI-Powered Chat Application with Image Generation was implemented as a scalable and user-friendly web application designed to provide intelligent conversations and AI-generated visual content in real time. The system was developed using a modern full-stack architecture to ensure efficient communication between frontend, backend, and AI services.

The frontend of the application was designed using modern web technologies such as React.js, HTML, CSS, and JavaScript to create an interactive and responsive user interface. The interface allows users to send messages, generate images through text prompts, view chat history, and interact with the AI system smoothly.

The backend was developed using Python and frameworks such as Flask or Django to manage API requests, user authentication, session handling, and communication with AI models. Natural Language Processing (NLP) techniques and machine learning models were integrated to process user queries and generate meaningful chatbot responses.

For image generation, generative AI models were used to convert textual descriptions into visual content. The application processes user prompts, sends requests to the AI image generation module, and returns generated images in real time. Efficient request handling and optimized processing methods were implemented to reduce response time and improve user experience.

5.2 Dataset and Experimental Setup

The experimental setup for the proposed system focused on evaluating chatbot response quality, image generation performance, and overall application efficiency. Various conversational datasets and publicly available language resources were used to train and test the AI chatbot model.

The chatbot system was trained using text-based conversational data to improve language understanding, context recognition, and response generation. Natural Language Processing techniques such as tokenization, text cleaning, and intent recognition were applied before training the model.

For image generation, generative AI models trained on large image-text datasets were used to produce images based on user prompts. The system was tested using different categories of prompts, including realistic scenes, creative artwork, educational content, and object-based descriptions.

The application was tested under multiple conditions to evaluate response time, scalability, chatbot accuracy, and image generation quality. User interactions were simulated to analyse system performance during real-time communication and concurrent requests.

5.3 Experimental Procedure

The implementation process began with designing the frontend interface and backend architecture for handling real-time communication between users and AI services. After establishing the application structure, the chatbot model was integrated using Natural Language Processing and machine learning techniques.

User input messages were processed through preprocessing stages such as text normalization, keyword extraction, and intent analysis. The processed text was then passed to the AI model to generate relevant and context-aware responses.

For image generation, user prompts were analysed and forwarded to the generative AI model. The system converted textual descriptions into visual representations and generated images accordingly. Generated outputs were then displayed within the application interface.

The system continuously monitored user interactions, processed requests, and delivered outputs in real time. Logging mechanisms were also included to record system activities, monitor performance, and identify areas for future improvements.

5.4 Evaluation Metrics

The performance of the proposed AI-Powered Chat Application was evaluated using several important metrics to ensure a comprehensive analysis of system quality and efficiency.

The primary evaluation parameters included:

1. **Response Accuracy:** Measures how correctly the chatbot understands and answers user queries.
2. **Response Time:** Evaluates the speed at which the system generates replies and images.
3. **User Interaction Quality:** Measures the naturalness and usefulness of chatbot conversations.
4. **Image Generation Quality:** Evaluates the clarity, creativity, and relevance of AI-generated images.
5. **System Scalability:** Determines the system's ability to handle multiple users and requests efficiently.
6. **Reliability and Stability:** Measures consistent system performance during continuous operation.

In addition to these metrics, user experience and interface responsiveness were also considered important evaluation factors. The combined analysis of these parameters provides a balanced understanding of the system's effectiveness, usability, and real-world applicability.

6. RESULTS

The performance of the proposed AI-Powered Chat Application with Image Generation was evaluated based on chatbot response quality, image generation capability, system efficiency, and user interaction performance. Multiple test cases and user prompts were used to analyse the effectiveness of the application under different conditions. The system was tested using various conversational inputs and creative image prompts to ensure stable and reliable operation.

The experimental analysis confirmed that the application successfully handled real-time communication and generated relevant AI-based responses and images efficiently. The system maintained stable performance during continuous interactions and demonstrated smooth integration between conversational AI and image generation modules.

6.1 Primary Outcomes

The experimental results showed that the proposed system achieved high response accuracy and improved user interaction quality compared to traditional chat applications. The AI chatbot was able to understand user intent effectively and generate meaningful responses for different types of queries, including informational, conversational, and creative requests.

The image generation module successfully created AI-generated images from textual prompts with good visual quality and relevance. The generated outputs matched user descriptions in most test scenarios, demonstrating the effectiveness of the generative AI model.

The system also maintained fast response time during both chatbot communication and image generation tasks. Efficient request processing and optimized backend architecture helped reduce delays and improve overall application performance.

6.2 Chatbot Behavior and System Performance

Further analysis revealed that the chatbot maintained stable conversational performance across multiple user interactions. The Natural Language Processing module effectively identified user intent, extracted meaningful information, and generated context-aware responses.

The chatbot could handle general communication, answering queries, and responding to creative prompts in a natural and interactive manner. Conversation flow remained smooth even during longer interactions, improving the overall user experience.

The system also demonstrated good scalability and stability under different workloads. Multiple user requests were processed efficiently without significant reduction in response quality or application speed.

The image generation system consistently produced creative and visually relevant outputs. Generated images showed acceptable quality, proper object representation, and improved prompt understanding for a wide range of user inputs.

6.3 Response Efficiency and User Interaction

One of the important outcomes of the proposed system was its ability to provide fast and efficient responses while maintaining a user-friendly interaction environment. The chatbot generated responses in real time, allowing smooth communication between users and the AI system.

The image generation module also processed prompts efficiently and delivered generated images within a reasonable time. The optimized backend architecture and API integration helped reduce processing delays and improve responsiveness.

The application interface contributed significantly to user engagement by providing clear navigation, responsive design, chat history management, and easy access to generated content. Users were able to interact with both the chatbot and image generation features without switching between different platforms.

The balance between intelligent responses, visual content generation, and application performance ensured that the system remained practical and efficient for real-world usage.

6.4 Robustness and Reliability

To evaluate system reliability, additional testing was performed using different categories of user prompts, repeated interactions, and multiple image generation requests. The application maintained consistent performance under varying conditions, demonstrating good robustness and operational stability.

The chatbot continued to generate meaningful responses even when handling diverse conversational styles and complex user inputs. Similarly, the image generation system maintained output quality across different creative prompts and visual requirements.

The modular system architecture also improved reliability by allowing independent management of chatbot services, image generation modules, and database operations. This design approach reduced system failure risks and simplified future upgrades.

The results indicate that the proposed AI-Powered Chat Application can provide intelligent communication and AI-generated visual content efficiently while maintaining stable performance, scalability, and user satisfaction in real-world environment.

7. DISCUSSION

7.1 Theoretical Implications

The findings of this study demonstrate that integrating conversational AI and image generation within a single platform can significantly improve user interaction and digital communication experiences. Instead of treating chatbot systems and image generation tools as separate technologies, the proposed framework combines both functionalities to create a more intelligent and interactive application environment.

The research also highlights the importance of Natural Language Processing (NLP), machine learning, and generative AI in modern software systems. The combination of intelligent conversation handling and AI-based content creation shows that AI applications can move beyond simple automation and provide more creative and personalized user experiences.

Additionally, the study emphasizes that modern AI applications should not only focus on response accuracy but also consider usability, scalability, response speed, and user engagement as important performance factors.

7.2 Practical Implications

From a practical perspective, the proposed AI-Powered Chat Application demonstrates that intelligent conversational systems and image generation technologies can be implemented using commonly available development tools and standard computational resources.

The system can be applied in multiple real-world domains such as:

1. Customer support systems
2. Educational platforms
3. Content creation applications
4. Social media tools
5. Design assistance systems
6. Personal AI assistants

The integration of chatbot and image generation features within a single platform improves productivity and reduces the need for multiple separate applications. Users can communicate with the AI system, generate creative content, and access visual outputs more efficiently.

7.3 Role of Artificial Intelligence in the Proposed System

Artificial Intelligence plays a central role in the overall functionality of the proposed application. Rather than functioning as a standalone chatbot or image generator, AI is used as an integrated system that combines language understanding, intelligent response generation, and creative visual content production.

Natural Language Processing enables the chatbot to understand user intent, analyse text input, and generate context-aware responses. Machine learning models help improve conversation quality and interaction accuracy over time. Similarly, generative AI models transform user prompts into meaningful and visually relevant images.

7.4 Security and Privacy Considerations

Since the proposed application handles user conversations, prompts, and generated content, security and privacy are important considerations in the system design.

User data such as chat history, login credentials, and generated images must be protected using secure storage mechanisms and controlled access policies. The system includes input validation, authentication mechanisms, and secure API communication to reduce security risks and unauthorized access.

Privacy protection is also important when processing user-generated prompts and AI interactions. Future improvements may include advanced encryption methods, secure cloud storage, and privacy-preserving AI techniques to enhance data protection and system reliability.

7.5 Limitations

Although the proposed system demonstrates promising results, several limitations still exist.

First, the quality of chatbot responses and generated images depends heavily on the AI models and training data used in the

system. In some situations, the chatbot may generate inaccurate or incomplete responses, especially for highly complex or ambiguous queries.

Second, image generation quality may vary depending on the clarity and detail of user prompts. Some prompts may produce inconsistent or less accurate visual outputs.

Third, real-time AI processing and image generation require significant computational resources, which may affect performance on low-end systems or during high user traffic.

Additionally, the current implementation mainly focuses on text-based interaction and image generation. Advanced features such as voice communication, multilingual support, personalized recommendations, and real-time collaborative AI interaction require further development.

8. FUTURE SCOPE

Several improvements can be explored in the future to enhance the proposed AI-Powered Chat Application with Image Generation. One important direction is the integration of more advanced Artificial Intelligence models to improve conversational understanding, contextual awareness, and image generation quality. Future versions of the system can incorporate transformer-based language models and advanced generative AI architectures to provide more accurate responses and highly realistic visual outputs.

Another important area for future development is real-time scalability and cloud deployment. Deploying the application on cloud platforms and testing it with large numbers of concurrent users would provide better insights into system performance under heavy workloads. This would also help improve application reliability, processing efficiency, and overall scalability in real-world environments.

The system can also be enhanced by introducing voice-based interaction and speech recognition features. This would allow users to communicate with the chatbot using voice commands and receive audio responses, creating a more natural and interactive experience.

In addition, multilingual support can be integrated to enable communication in different languages. This would make the application more accessible to users from diverse regions and improve overall usability.

Future research may also focus on personalized AI interactions by analysing user preferences, conversation history, and usage patterns. Personalized recommendations and adaptive responses can significantly improve user engagement and satisfaction.

Another promising direction is the addition of advanced image editing and customization features. Users could modify generated images, apply filters, edit objects, or generate multiple design variations within the same platform.

9. CONCLUSION

In conclusion, this paper presents an AI-Powered Chat Application with integrated Image Generation capabilities designed to improve digital communication and creative content generation through Artificial Intelligence technologies. The proposed system successfully combines conversational AI, Natural Language Processing, and generative AI models within a unified and scalable application framework.

The developed application enables users to interact with an intelligent chatbot and generate AI-based images using simple textual prompts. By integrating both functionalities into a single platform, the system improves user convenience, interaction quality, and creative productivity compared to traditional chat applications.

The implementation results demonstrate that the proposed system provides efficient response generation, smooth user interaction, and high-quality AI-generated visual outputs. The modular architecture of the application also allows future integration of advanced AI models, additional features, and improved scalability without affecting existing system functionality.

Furthermore, the study highlights the growing importance of Artificial Intelligence in modern software applications and demonstrates how conversational systems and generative AI can work together to create more intelligent and interactive digital platforms.

Although certain limitations related to computational resources, response quality, and scalability still exist, the proposed application provides a strong foundation for future research and development in AI-powered communication and creative systems.

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