

Echo Query Hub: A Versatile Artificial Intelligence Conversational Framework Bridging Healthcare and Multi-Domain Applications

Received 04/29/2025
Review began 05/18/2025
Review ended 10/07/2025
Published 10/07/2025

© Copyright 2025

Kaushik et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI:

<https://doi.org/10.7759/s44389-025-05854-w>

Krishna Kaushik ¹, Pankaj Pankaj ¹, Tisha Bansal ¹, Tanmai Kulshreshtha ¹

¹. Department of Electrical Engineering, Dayalbagh Educational Institute, Agra, IND

Corresponding authors: Krishna Kaushik, sharmakrishna0112@gmail.com, Pankaj Pankaj, pankaj95484636@gmail.com, Tisha Bansal, tishabansal90@gmail.com, Tanmai Kulshreshtha, tanmai.kul@gmail.com

Abstract

In today's fast-changing world of digital communication, artificial intelligence (AI)-powered chat systems stand as pivotal conduits bridging the gap between users and machines. However, traditional chat systems often fall short of delivering personalized and intuitive interactions, limiting their potential to truly enhance user experiences. In response to these limitations, our research presents the Echo Query Hub - an innovative AI chat platform designed to transcend conventional boundaries and redefine digital engagement. At the core of Echo Query Hub lies a commitment to empowerment and personalization, offering users unprecedented agency over their digital interactions. Through field-specific customization, users can curate their digital experience to align with their individual interests and preferences, ensuring that every interaction is relevant and enriching. Leveraging advanced features such as image uploads and voice input capabilities, Echo Query Hub elevates the depth and richness of user interactions, making the experience more immersive and inclusive. This article outlines a broad perspective on the Echo Query Hub Framework, including its objectives, methodology, key features, and implications for the future of AI-driven communication. By prioritizing user experience and innovation, we aim to pave the way for a new era of personalized, accessible, and transformative digital engagement.

Categories: AI applications, Generative AI for healthcare, Web applications

Keywords: user empowerment, react frontend, python backend, digital engagement, field-specific customization, image uploads, voice input, user experience, innovative technology, personalized ai

Introduction

In the modern era of technology, artificial intelligence (AI)-powered chat systems are revolutionizing digital engagement by offering personalized and innovative solutions [1]. These systems have become highly advanced and are now instrumental across industries such as healthcare, finance, and technology, where they seamlessly facilitate tasks like finding information and aiding in decision-making [2]. Given this exponential growth and potential, chatbot technology is increasingly being adopted to automate various administrative processes.

One prominent example is Microsoft, which has emerged as a leader in applying AI to the healthcare sector. According to Insider Intelligence, AI may handle up to 73% of administrative duties in healthcare. Additionally, the use of chatbots is projected to generate annual savings of \$11 billion across sectors like healthcare, banking, and retail by 2023 [3]. This illustrates the significant economic and operational impact AI-powered chat systems are beginning to have.

There are different types of chatbots available today, each with unique features and methods of interaction. For instance, ChatGPT utilizes advanced algorithms to generate contextual responses, Gemini connects with external programs for smooth integration, and Claude emphasizes understanding user intent to provide helpful answers. These distinctions highlight the breadth of chatbot functionality currently in use. A comprehensive evaluation in a study by Pande et al. [4] compares multiple AI models, including Google Gemini, further illustrating the diversity and strengths of modern chatbot systems.

Numerous studies have examined the impact of these systems. A review [5] analyzed ChatGPT's influence in business and education, highlighting its ability to enhance customer service, generate content, and support decision-making. However, issues such as biased responses, contextual misunderstandings, and privacy concerns were also noted. Further, other studies [6] point out that while ChatGPT has proven valuable for communication and learning, it still faces limitations like language comprehension challenges and occasional inaccuracies.

Building upon these insights, another study [7] assessed ChatGPT's role in areas like social interaction, problem-solving, and information retrieval. While it simplifies user conversations and provides helpful assistance, concerns about fairness and user data privacy remain. These limitations present an

How to cite this article

Kaushik K, Pankaj P, Bansal T, et al. (October 07, 2025) Echo Query Hub: A Versatile Artificial Intelligence Conversational Framework Bridging Healthcare and Multi-Domain Applications. Cureus J Comput Sci 2 : es44389-025-05854-w. DOI <https://doi.org/10.7759/s44389-025-05854-w>

opportunity for innovation aimed at enhancing user experience and addressing identified gaps.

In the educational domain, Wollny et al. [8] reviewed the role of chatbots in pedagogy, mentorship, and personalization. The study identified key research challenges and proposed future directions, supporting our inclusive goal of developing a platform not limited to a specific field but serving a wide range of user interests.

To that end, our research framework focuses on improving user engagement by introducing personalized features and addressing previous limitations. By incorporating diverse interaction methods - such as image uploads and voice input - our system enhances accessibility and aims to deliver more accurate and comprehensive responses. Central to this design is a user-centric approach that prioritizes ease of use and effective communication with AI systems.

Our goal with Echo Query Hub is to make AI-based chat interactions more accessible, intuitive, and personalized. Whether the user is interested in finance, health, or entertainment, the platform is designed to adapt to their preferences and provide a tailored experience.

To make the platform more user-friendly, especially for individuals with limited technical skills, we emphasize a simple and intuitive design. Enhancements like voice-based interaction and image upload functionality are added to enrich the quality and accuracy of responses. This allows users to engage more dynamically with the system, making the chat experience more interactive and rewarding. This approach aligns with the findings of Imran and Almusharraf [9], which highlights the importance of multimodal capabilities in enhancing user interaction. Reflecting this, our platform already supports text, audio, and image inputs to deliver a richer and more accessible experience.

To address a notable limitation in previous chat systems - namely, the inability to interact with specific parts of an image - we introduce a crop widget feature. This functionality allows users to select and interact with a particular section of an uploaded image. Echo Query Hub then analyzes the cropped section and returns relevant, context-specific information, further personalizing and refining the interaction.

In conclusion, our framework strives to create a more inclusive, precise, and engaging AI chat environment. By enhancing user control, interaction modalities, and response accuracy, we aim to redefine the standard for AI-powered communication and make it accessible and enjoyable for users of all backgrounds and abilities.

Materials And Methods

Main idea

The main idea of our framework is to leverage the Gemini API across various fields such as education, health, ministry, beauty, etc., within an AI chat system. Our system is designed to provide tailored responses to user queries, ensuring relevance by limiting responses to the selected field of interest. By integrating the Gemini API into diverse domains, we aim to offer users a comprehensive and personalized experience, catering to their specific needs and interests within each respective field. Through this approach, we strive to enhance user engagement and satisfaction while facilitating seamless interactions across a wide range of topics and industries.

Research and requirements analysis

Conversational AI has revolutionized various industries, including healthcare, finance, and retail. A study by Chu [10] introduces Recipe Bot, a conversational agent that helps users find recipes by matching dish names and ingredients. The chatbot uses Google Dialogflow and Spoonacular API.

The development process initiated with an extensive research phase aimed at understanding existing AI chat systems and user interaction patterns. Through stakeholder interviews, user surveys, and market analysis, we identified preliminary requirements and user preferences to inform our framework objectives.

Technology stack selection

A critical aspect of the framework involved selecting an appropriate technology stack to support the envisioned functionality of the Echo Query Hub platform. Preliminary evaluations of frontend and backend technologies were conducted, with React.js identified for frontend development and Python considered for backend implementation. Further refinement and selection of specific technologies are ongoing.

Methodology and system architecture design

The system architecture design phase commenced with the exploration of architectural patterns and design principles conducive to scalability, modularity, and maintainability. Initial designs adopted microservice architecture, though specific component implementations and integration strategies are subject to further refinement.

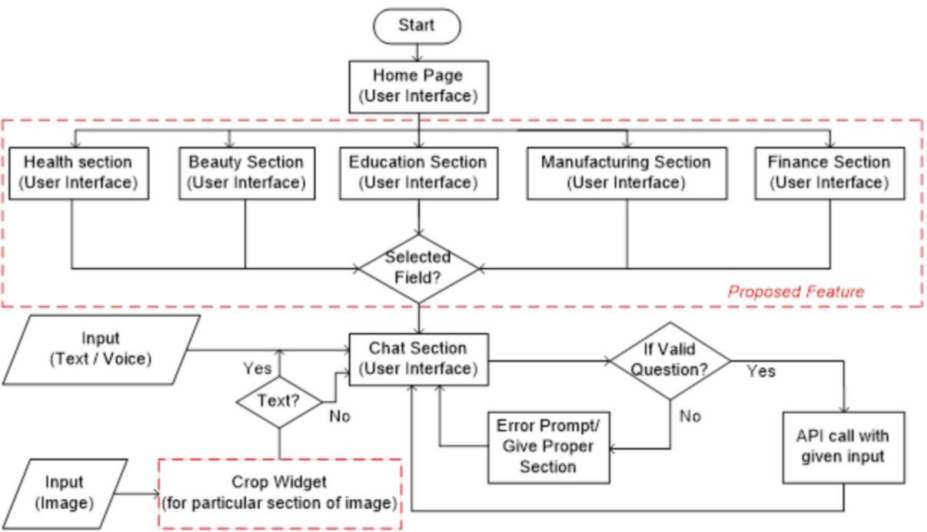


FIGURE 1: Flowchart of Methodology

API, Application Programming Interface

Figure 1 depicts the methodology behind the creation of a query hub platform called Echo Query Hub. The platform allows users to input questions through text, voice, or image, and delivers answers across various domains, with a focus on health.

The flowchart starts with the user landing on the home page, which has five sections: Health, Beauty, Education, Manufacturing, and Finance. The user selects a field and then has the option to either refine their questions through a chat section or proceed by providing an input. This input can be text, voice, or an image.

The flowchart then splits into two paths depending on whether the user has a question or simply provides an input. If the user has a question, the system checks to see if it contains the word, Ted. If it does not contain Ted, an error prompt appears, and the user is asked to provide a section.

If the user does not have a question and instead provides an input, the system checks to see if the input is an image. If it is an image, a crop widget is used to select a specific portion of the image. Finally, an API call is made with the given input.

The result section of the flowchart states that the Echo Query Hub platform has been successfully developed and demonstrates efficient query answering capabilities across various domains.

To make the Gemini API more user-friendly, some modifications were made to the open-source version. Now, when the API is called to respond to user queries, a parts section is included at the same time, where the user's specified field of interest is provided. The modifications are as follows:

"You are an expert in the field of {prompt.key}. Provide informative and accurate responses to user queries within this domain. If a question falls outside the scope of {prompt.key}, respond with a message indicating that the query is not related to {prompt.key}, and guide the user to the appropriate section for their inquiry and also give the appropriate section for the query. For example: If the user asks about nutrition, exercise or medical conditions provide relevant health information, If the user inquires about a topic unrelated to health, respond with a message like -This question is not related to health. Please refer to the appropriate section for your inquiry; this applies to all fields."

Note: {prompt.key} represents the section chosen by the user and this logic should be applied consistently for all possible domains.

Feature implementation

Along with integrating the Gemini API in a categorized way, we also implemented some new features like voice input and crop image queries.

The voice input feature enables the platform to answer the queries asked by the user in voice form [11]. The platform is also capable not only of taking the queries through voice input but also can make the response to the user in voice mode. Moreover, the image-based queries are also taken care of by the platform [12]. The crop image query feature enables the user to upload an image and ask the question to a particular section of the image which makes the platform more efficient according to user need.

Results

The Echo Query Hub platform has been successfully developed and demonstrates efficient query answering capabilities across various domains, with a particular emphasis on the health domain. The platform offers ease of access, accessible from any location, providing users with convenient access to tailored information. Based on the experimental setup described in the Materials and Methods section, Echo Query Hub was tested in a local environment using predefined user queries based on user preference. The system came out with consistent performance, with accurate and timely responses across all test cases.

Health domain query response efficiency

To assess the platform's performance in answering health-related questions, we subjected it to symptoms, medication, and healthy lifestyle habits questions. The Echo Query Hub answered correctly and promptly, bringing back relevant answers from the API for every query.

These answers were seamlessly fed into the chat interface, delivering users clear and useful health information in real time. This reflects the broader trend in healthcare where AI technologies are increasingly used to deliver personalized and timely medical insights. As discussed by Pavunraj et al. [13], generative AI plays a pivotal role in transforming healthcare by enabling customized treatment recommendations through real-time data integration and intelligent algorithms.

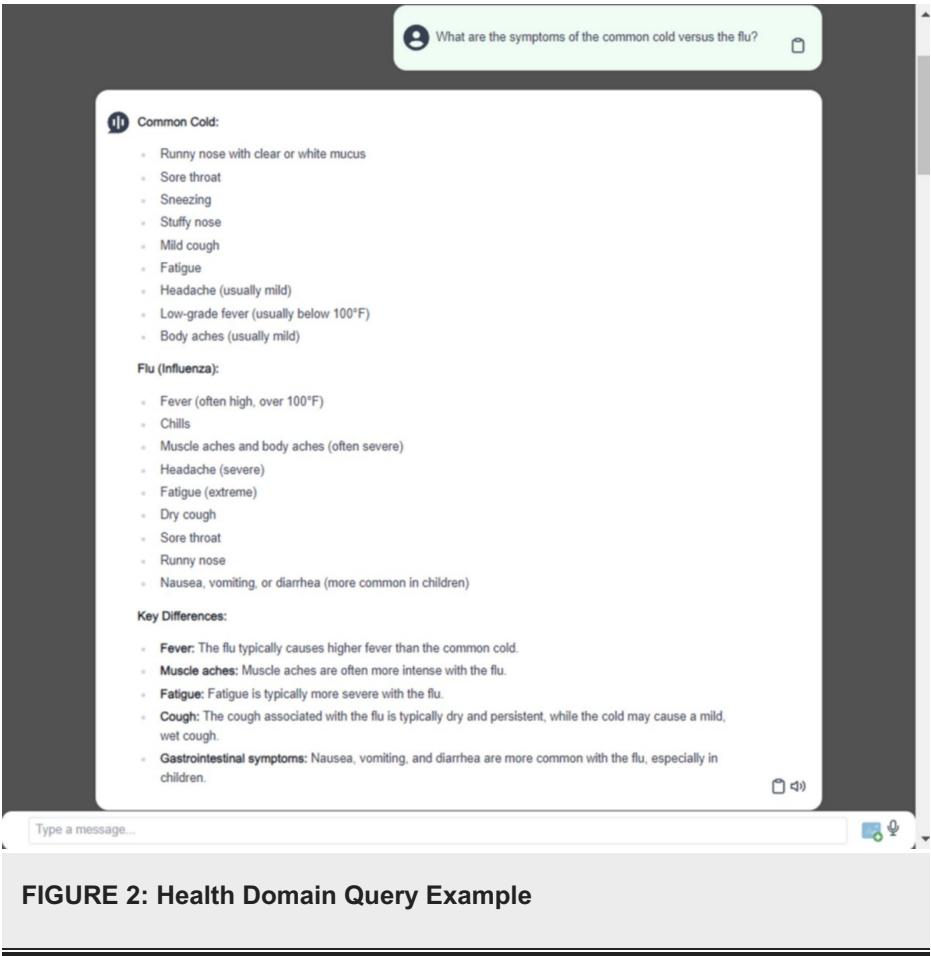


FIGURE 2: Health Domain Query Example

Figure 2 shows the platform's efficacy in action-when one poses a health-related query, the bot gets it right and fast, demonstrating its efficacy in responding to health queries.

The problem about user experience outlined by Kalathot [14] can be effectively addressed through our platform, EchoQuery Hub. By aligning query responses with individual user preferences, the platform enhances satisfaction and boosts overall engagement.

Out-of-domain query handling

To assess the platform's ability to handle inquiries beyond the health domain, we deliberately introduced questions related to finance and entertainment. The platform effectively identified these queries as falling outside its health focus area and communicated this clearly to the user. This demonstrates the platform's versatility in discerning the relevance of user queries across different domains.

As already mentioned about the changes made in API, the parts section clearly represents that API is capable of handling out-of-domain queries by providing appropriate message in parts section.

The impact of changes implemented in API can be seen in Figure 3 which represents that chatbot is ignoring the out of domain query which enhances the user experience and makes the system more user reliable.

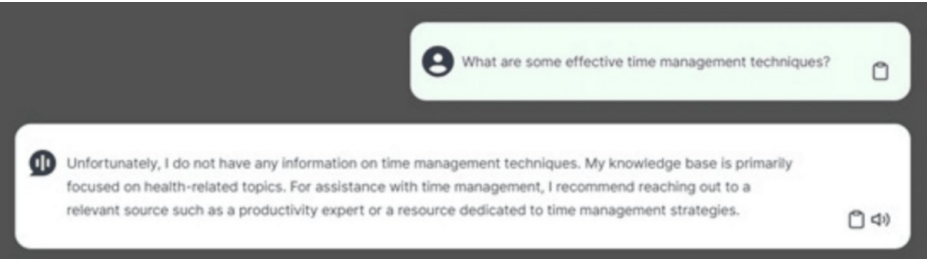


FIGURE 3: Out-of-Domain Query Example

Categorized Gemini vs non-categorized Gemini

In our research, we conducted an analysis comparing the accuracy of two distinct models for predicting Gemini, categorized and normal, in a given dataset [15] which is shown in Table 1. To achieve this comparison, we made a set of questions including the original_field in which the question really lies. Then each question was passed through both the models. The answers from both the models were analyzed and the field in which the answer mostly related is marked in the respected column of the question named predicted_field_category_gemini field and predicted_field_normal_gemini for both the models.

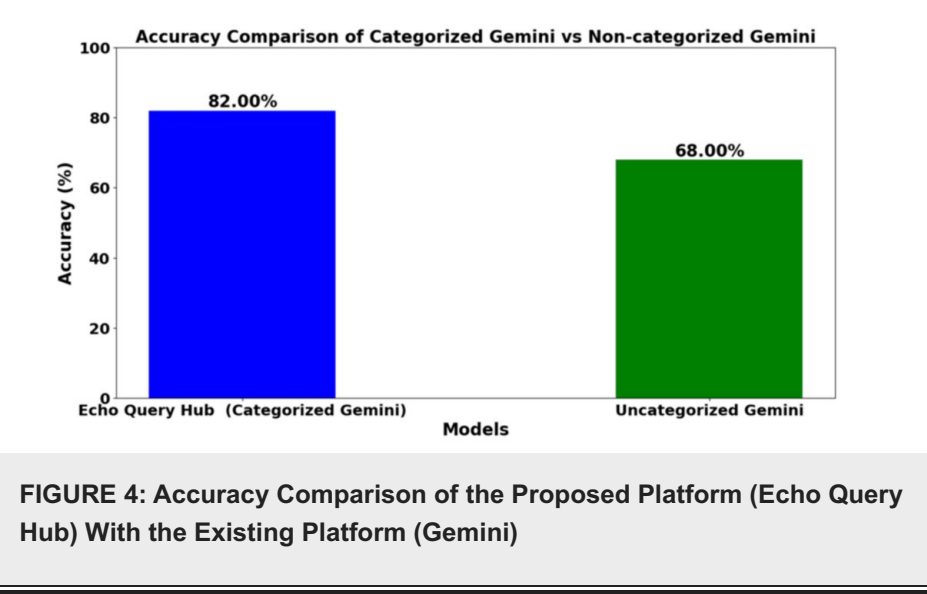
Question	original_field	predicted_field_category_gemini	predicted_field_normal_gemini
Who is considered the father of modern education?	Education	EDUCATION	EDUCATION
In which country was the first university established?	Education	EDUCATION	TECHNOLOGY
What does STEM stand for in the context of education?	Education	TECHNOLOGY	TECHNOLOGY
Who wrote the famous book 'To Kill a Mockingbird,' often studied in high school English classes?	Education	EDUCATION	EDUCATION
What is the capital of Australia?	Education	EDUCATION	EDUCATION
Who developed the theory of cognitive development in children?	Education	EDUCATION	EDUCATION
What is the capital of France?	Education	EDUCATION	NONE
What is the chemical symbol for oxygen?	Education	SCIENCE	SAFETY
What is the closest star to Earth?	Education	TECHNOLOGY	TECHNOLOGY
Who wrote 'Romeo and Juliet'?	Education	LITERATURE	N/A
What does BMI stand for in healthcare?	Healthcare	HEALTHCARE	HEALTHCARE
Which organ produces insulin in the human body?	Healthcare	HEALTHCARE	HEALTHCARE
What is the medical term for high blood pressure?	Healthcare	HEALTHCARE	HEALTHCARE
What is the largest organ in the human body?	Healthcare	HEALTHCARE	BEAUTY

What does CPR stand for?	Healthcare	HEALTHCARE	HEALTHCARE
What is the medical term for the collarbone?	Healthcare	HEALTHCARE	HEALTHCARE
What is the smallest bone in the human body?	Healthcare	HEALTHCARE	HEALTHCARE
What is the medical term for the voice box?	Healthcare	HEALTHCARE	HEALTHCARE
What does DNA stand for?	Healthcare	TECHNOLOGY	HEALTHCARE
What is the normal resting heart rate for adults in beats per minute?	Healthcare	HEALTHCARE	TECHNOLOGY
Who is the CEO of Tesla?	Technology	TECHNOLOGY	TECHNOLOGY
What does HTML stand for?	Technology	TECHNOLOGY	TECHNOLOGY
What is the main function of a CPU in a computer?	Technology	TECHNOLOGY	TECHNOLOGY
Which company developed the first graphical web browser?	Technology	TECHNOLOGY	TECHNOLOGY
What is the latest version of the Android operating system?	Technology	TECHNOLOGY	TECHNOLOGY
What is the main component of a photovoltaic cell?	Technology	TECHNOLOGY	TECHNOLOGY
What is the name of the first commercially available computer?	Technology	TECHNOLOGY	TECHNOLOGY
What does URL stand for?	Technology	TECHNOLOGY	TECHNOLOGY
What is the most commonly used programming language for web development?	Technology	TECHNOLOGY	TECHNOLOGY
What is the name of the process used to convert sunlight into electricity?	Technology	TECHNOLOGY	EDUCATION
What does SPF stand for in skincare?	Beauty	HEALTHCARE	BEAUTY
What is the primary ingredient in most shampoos?	Beauty	BEAUTY	TECHNOLOGY
Which vitamin is known for its benefits to skin health?	Beauty	BEAUTY	HEALTHCARE
What is the purpose of a toner in a skincare routine?	Beauty	BEAUTY	BEAUTY
Who is considered one of the most influential makeup artists of all time?	Beauty	BEAUTY	BEAUTY
What is the purpose of a primer in makeup?	Beauty	BEAUTY	BEAUTY
Which ingredient is commonly used in anti-dandruff shampoos?	Beauty	HEALTHCARE	HEALTHCARE
What does CC cream stand for in beauty products?	Beauty	BEAUTY	BEAUTY
Who is known for the phrase 'Beauty is in the eye of the beholder'?	Beauty	BEAUTY	EDUCATION
What is the main function of a serum in skincare?	Beauty	BEAUTY	BEAUTY
What does JIT stand for in manufacturing?	Manufacturing	MANUFACTURING	MANUFACTURING
What is the process of converting raw materials into finished goods called?	Manufacturing	MANUFACTURING	CORRECT
Which industry primarily uses CNC machines?	Manufacturing	MANUFACTURING	MANUFACTURING
What does ISO stand for in the context of quality management?	Manufacturing	MANUFACTURING	TECHNOLOGY
Who is credited with developing the assembly line production method?	Manufacturing	MANUFACTURING	MANUFACTURING
What does TQM stand for in the context of quality management?	Manufacturing	TECHNOLOGY	MANUFACTURING
What is the name of the process used to shape metal by hammering?	Manufacturing	MANUFACTURING	MANUFACTURING
Who invented the cotton gin?	Manufacturing	TECHNOLOGY	MANUFACTURING
What is the term for the process of melting metal and pouring it into a mold?	Manufacturing	MANUFACTURING	MANUFACTURING

What does ERP stand for in manufacturing?	Manufacturing	MANUFACTURING	TECHNOLOGY
---	---------------	---------------	------------

TABLE 1: Efficiency Comparison Dataset

The categorized Gemini model exhibited an accuracy of 82.0%, while the normal Gemini model demonstrated an accuracy of 68.0% which can also be seen in Figure 4. These results suggest that the categorized approach yields superior accuracy in predicting Gemini compared to the conventional model.



This finding underscores the importance of considering categorical factors in predictive modeling tasks, potentially enhancing the precision and applicability of such models in practical settings. Such insights contribute to the advancement of predictive modeling techniques and can inform decision-making processes across various domains reliant on accurate predictive analytics.

Crop widget functionality

The crop image query feature enables the user to upload an image and ask the question to a particular section of the image which makes the platform more efficient according to user need.

When a complete image of a machine is provided, the system can effectively analyze the various components, their arrangement, and their overall structure. This analysis enables the system to generate a comprehensive description of the machine as shown in Figure 5.

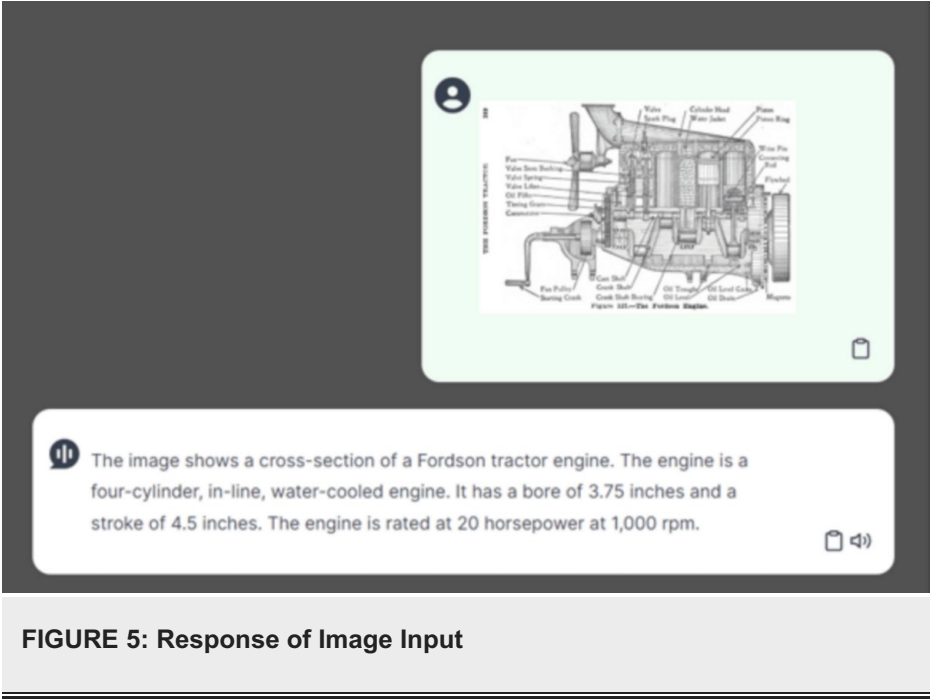


FIGURE 5: Response of Image Input

When a particular section of the image is provided, the system can effectively analyze this section carefully. This analysis enables the system to generate a comprehensive description of that particular section as shown in Figure 6.



FIGURE 6: Response of Crop Image Input

Overall platform performance

Our findings collectively showcase the platform's robustness and efficiency in addressing user inquiries within the health domain, while also demonstrating its ability to appropriately handle queries from other domains. These results highlight the platform's potential for versatile and user-centric interaction across various domains. The Echo Query Hub exhibits promising capabilities in catering to user information needs and ensuring a tailored and relevant experience.

To check the platform performance with real life questions, we asked some questionnaires to both the platforms i.e. normal Gemini and categorized Gemini. The performance of categorized Gemini came more than the normal Gemini when we compared both the results in user point of view in a specific domain.

Discussion

Echo Query Hub has made strong progress in building an AI-driven chat system, especially in the healthcare sector. Its user-focused design - with features like field-specific customization, image uploads, and voice input - makes conversations more personal and easier for users. This sets a higher standard for creating AI platforms that feel more natural and intuitive. While the platform has performed well, future improvements should aim at making it even faster, more scalable, and ready to support more industries. Future work will focus on optimizing system scalability, enriching domain-specific datasets, and incorporating multi-language capabilities to further enhance user experience.

Conclusions

We successfully designed and tested the Echo Query Hub platform, an AI-driven chat system that answers user questions accurately, especially in health. We found that Echo Query Hub answers domain-specific queries better than other chatbots. User experience, personalization, and advanced features like field-specific customization, image uploads, and voice input make our framework valuable. A new user-centric paradigm for AI chat systems makes interactions more intuitive and entertaining. While successful, our research creates doors for future work. This includes optimizing scalability, performance, and user experience, integrating with other domains, and expanding capabilities to meet more user needs. In general, our research effort advances user-centric AI chat systems. Echo Query Hub redefines digital engagement with a personalized, accessible, and interaction experience, setting new benchmarks for user-friendly design and enabling a more intuitive digital future.

Appendices

Appendix A: Efficiency Comparison Dataset

The Efficiency Comparison Dataset consists of 50 questions spanning five domains: Education, Healthcare, Technology, Beauty, and Manufacturing. Each question is labeled based on responses from two models, with predicted domains recorded in the columns `predicted_field_category_gemini` and `predicted_field_normal_gemini`. The dataset has been made publicly available and can be accessed through the following link:

https://drive.google.com/file/d/1yA0QGVqbXMsxPEyKbjgQRzZ_VnRvSENS/view

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Krishna Kaushik, Pankaj Pankaj, Tisha Bansal, Tanmai Kulshreshtha

Acquisition, analysis, or interpretation of data: Krishna Kaushik, Pankaj Pankaj, Tisha Bansal, Tanmai Kulshreshtha

Drafting of the manuscript: Krishna Kaushik, Pankaj Pankaj, Tisha Bansal, Tanmai Kulshreshtha

Critical review of the manuscript for important intellectual content: Krishna Kaushik, Pankaj Pankaj, Tisha Bansal, Tanmai Kulshreshtha

Supervision: Krishna Kaushik, Pankaj Pankaj, Tisha Bansal, Tanmai Kulshreshtha

Disclosures

Human subjects: All authors have confirmed that this study did not involve human participants or tissue.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Rahman AM, Mamun AA, Islam A: Programming challenges of chatbot: Current and future prospective. 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Dhaka, Bangladesh. 2017, 75-78. [10.1109/R10-HTC.2017.8288910](https://doi.org/10.1109/R10-HTC.2017.8288910)
2. Haleem A, Javaid M, Qadri MA, Singh RP, Suman R: Artificial intelligence (AI) applications for marketing: A

- literature-based study. *International Journal of Intelligent Networks*. 2022, 3:119-132. [10.1016/j.ijin.2022.08.005](https://doi.org/10.1016/j.ijin.2022.08.005)
3. Economic Impact and Projections Report: The Integration of AI and Emerging Technologies (2025-2030). (2025). <https://www.joineta.org/blog/economic-impact-and-projections-report-the-integration-of-ai-and-emerging-technologies-2....>
4. Pande A, Patil R, Mukkemwar R, Panchal R, Bhoite S: Comprehensive study of Google Gemini and text generating models: understanding capabilities and performance. 15th International Conference on Advances in Computing, Control, and Telecommunication Technologies. 2024, 856-863.
5. Shaji Georg A, Hovan George AS, Gabrio Martin AS: A review of ChatGPT AI's impact on several business sectors. *Partners Universal International Innovation Journal*. 2023, 1:9-23. [10.5281/zenodo.7644359](https://doi.org/10.5281/zenodo.7644359)
6. Shihab SR, Sultana N, Samad A: Revisiting the use of ChatGPT in business and educational fields: Possibilities and challenges. *BULLET: Jurnal Multidisiplin Ilmu*. 2023, 2:534-545.
7. Kalla D, Smith N, Samaah F, Kuraku S: Study and analysis of chat GPT and its impact on different fields of study. *International Journal of Innovative Science and Research Technology*. 2023, 8:827-833.
8. Wollny S, Schneider J, Di Mitri D, Weidlich J, Rittberger M, Drachsler H: Are we there yet? - A systematic literature review on chatbots in education. *Frontiers in Artificial Intelligence*. 2021, 4:654924. [10.3389/frai.2021.654924](https://doi.org/10.3389/frai.2021.654924)
9. Imran M, Almusharraf N: Google Gemini as a next generation AI educational tool: a review of emerging educational technology. *Smart Learning Environments*. 2024, 11:22. [10.1186/s40561-024-00310-z](https://doi.org/10.1186/s40561-024-00310-z)
10. Chu J: Recipe bot: The application of conversational ai in home cooking assistant. 2021 2nd International Conference on Big Data & Artificial Intelligence & Software Engineering (ICBASE), Zhuhai, China. 2021, 696-700. [10.1109/ICBASE53849.2021.00136](https://doi.org/10.1109/ICBASE53849.2021.00136)
11. O'Shaughnessy D: Interacting with computers by voice: automatic speech recognition and synthesis. *Proceedings of the IEEE*. 2003, 91:1272-1305. [10.1109/jproc.2003.817117](https://doi.org/10.1109/jproc.2003.817117)
12. Su S: Conversational Image Recognition Chatbot, CS230-Fall 2020 Final Project Report. (2020). http://cs230.stanford.edu/projects_fall_2020/reports/55800280.pdf.
13. Pavunraj D, Mathan Kumar A, Anbumaheshwari K: AI in personalized treatment planning. *AI Insights on Nuclear Medicine*. Satishkumar D, Sivaraja M (ed): IGI Global Scientific Publishing, Hershey, PA; 2025. 117-142. [10.4018/979-8-3373-1275-0.ch006](https://doi.org/10.4018/979-8-3373-1275-0.ch006)
14. Kalathot R: Artificial intelligence for dynamic user experience personalization in SaaS. *Journal of Data Analysis and Critical Management*. 2025, 1:1-8. [10.64235/20rneq83](https://doi.org/10.64235/20rneq83)
15. Pankaj, Efficiency Comparison Dataset [Online]. (2024). https://drive.google.com/file/d/1yA0QGVqbXMsxPEyKbjgQRzZ_VnRvSENS/view.