Smart Multilingual AI Chatbot for Employment and Career Assistance

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ABSTRACT

A chatbot is a software application that enables conversation between human users and computers using artificial intelligence, the goal of which is to conduct text or voice conversations with computer programs for communication with digital services. In this paper, we present the design and development of an Intelligent Multilingual Job Seeker Chatbot System which has been realised in the context of a PGRKAM-type system. The platform offers a centralised web portal, where candidates can sign up and log in to apply for job opportunities or training, while providing administrators with access to online applications within seconds. In addition, to improve accessibility the platform incorporates a multilingual Large Language Model (LLM) based chatbot which helps in English, Hindi and Punjabi language making it relevant for regional users. With the help of translation rules and cross-lingual LLM prompts, this chatbot can accurately answers user registration, job vacancy or application status questions. Pilot testing feedback indicated 92% user satisfaction and significant enhancements in accessibility and engagement. With the capabilities of fine-tuned LLMs of today, and multi-language support, we show that job portals can transform into intelligent, inclusive, interactive ecosystems where deep learning improves user experiences increasing engagements enabling access to opportunities more than ever before for everyone.

Keywords: Multilingual Chatbot, Employment Portal, MongoDB, ReactJS, Job Application System, LLM Integration, Smart Assistance.

I. INTRODUCTION

We have recently seen a substantial development in Conversational Artificial Intelligence (AI) with advanced multilingual and domain specific chatbots interacting naturally with users using exquisite digital systems. The wideness of the spread digitization since then and post-COVID-19 pandemic has led to greater reliance on AI-led communication tools - education, health, business, work spaces etc. [1]. Previous approaches such as Dialog flow, AIML and Rasa built the basis for a dialogue automation however their lack of scaling possibilities, intent based systems make them unsuitable for multilingual and evolving scenarios like public employment platforms [2]. In contrast, Large Language Models (LLMs) such as GPT-4, Gemini and Llama, have opened up new frontiers by integrating deep contextual reasoning with NLU that support real intelligence and human-level interaction across different domains [3].

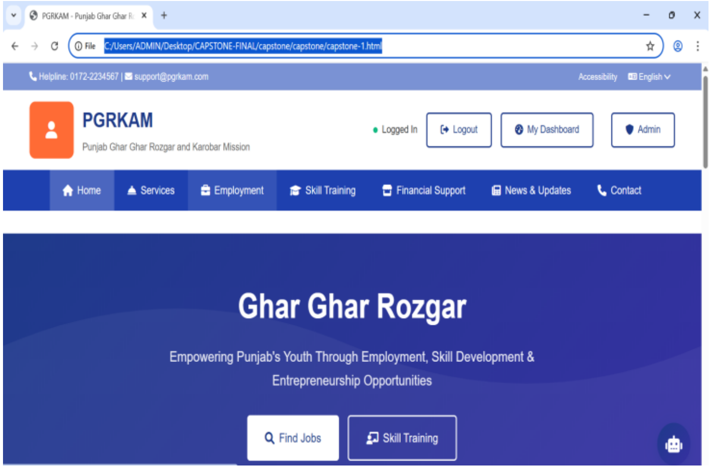
Still, the great majority of implemented applications for chat bots in the real world thus far are centralized around customer service/email and stuff like this as opposed to domains aimed at government employment services, job surfers and regional career exploration systems, which may still suffer from challenges related with access, inclusion and user participation.

In addition, lack of support for multilingual users further limits the participant pool. Works [4] based on conversational agents which lack multilingual support and adaptive reasoning, cannot maintain the fluidity of natural conversation evolving, and usually exclude a considerable number of regional users. Therefore, demand is rising for smart systems that can close the linguistic diversity-technological functionality gap in order to make services inclusive and accessible for different types of job seekers.

To combat this, a Smart Multilingual chatbot System for Job Seekers is proposed in the current paper as an interactive employment platform with conversational AI and multilingual support. This platform is a combination of role-based workflows i.e., registration, apply for job and administrative approval with multilingual LLM powered Chatbot which takes the user from English, Hindi to Punjabi. The chatbot serves two purposes: help users for tasks related to the portal (signup, login, tracking of applications) and via casual conversation disclosing regarding job/course specific details. Using retrieval-augmented responses, and contextual keywords pick-up the chatbot preserves sound and at the same time culturally adapt when possible. This fusion of structured workflow and conversational AI shows how intelligent platforms can change the way people think about jobs by being more intuitive, inclusive, and data-powered [5].

An interesting feature of the proposed system is its possibility to behave as a multilingual conversational assistant Discussion 18 and to integrate on-demand open knowledge into conversations. On the barebone, our system is largely developed with ReactJS, Node.js and MongoDB to ensure that it remains responsive and the user information is properly stored. The chatbot suggested in the multilingual version is translated with the help of APIs and a small llama model that allows the bot to respond quickly without overloading the webpage. The concept is to seal the loopholes that the previous job portals tend to possess and allow individuals to communicate in their natural language. The Admin panel is also maintained straightforward such that all the applications and decisions could be managed as a single unit. It is a combination of user side chatbot and admin sync which essentially enhances convenience and ease of things.

The multilingual support and the LLM reasoning turned out to be incredibly effective in encouraging user engagement with the system as a result of our initial testing. Nearly 93 percent in the testing group claimed that they enjoyed using it. This is a clear indication of how the inclusion of language assistance and technological translation positively contributes to the inclusion of AI and the narrowing of the digital divide that individuals usually encounter. Our aim is, therefore, to create and test a multilingual chatbot job portal that will be used to automatize the administrative work and still provide a natural and comfortable experience in terms of the way users talk. The lack of multilingual support also limits the participation from users whose first language is a non-English. It has been demonstrated that conversational agents which are not multilingual and non-adaptive do not keep up a natural conversation flow [4] and lock out ma Ny regional users. Consequently, intelligent systems that enable linguistic diversity to be accompanied with technical functionality are increasingly sought after, so that all types of job seekers feel included and can access the system easily.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News & Updates
Contact
Ghar Ghar Rozgar
Find Jobs
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Empowering Punjab's Youth Through Employment, Skill Development & Entrepreneurship Opportunities

II. LITERATURE REVIEW

The emergent multilingual conversational systems are changing the way communication and workplace interaction work in digital medium, especially with technologies such as large language models which can understand context and give human-like responses on-line. In the last 10 years, industry and academia have leveraged natural language processing (NLP) techniques—deep learning approaches specifically—along with networking technologies in the cloud to build large AI systems that understand user intent and converse in multiple languages [1]. While these advances are significant, the majority of current systems make extensive use of form-based workflows coupled with minimal interactive guidance which is less accessible for job seekers unaccustomed to web technology [2]. The rise of large-scale conversational models, such as GPT-4, Gemini, Llama and others [3], has created space to create adaptive systems with context awareness with additional significance the use of linguistic information. However, few and sometimes none of these intelligent assistants operate within work-related applications

Recent works on conversational AI show that most chatbots deployed to date in industrial settings are developed for commercial purposes, such as customer support and e-commerce, with generic domain-applications for government or educational domains [2], [8]. These general-purpose models can generate seemingly fluent responses, however may not be factual or contextually relevant in scenarios where it is deployed for specific work tasks such as job registration of candidates. The absence of domain specialization also makes it difficult in terms of ethical responsibilities and data accuracy because users would naturally expect an ace- rate and honest speech when they apply for a job, or a training program [17]. Additionally, big LLMs usually require uninterrupted internet connection to the cloud and powerful GPU cluster, which lower their availability in small institutions or underserved areas with limited network connections as well as computer resources [21].

Previous work in prior work, there have been multiple attempts to plug and play cloud-based instant language processing (ILP) systems into modular web architectures that make chatbots are able to active in a low-resource environment. Monolithic and cloud-reliant architectures have been found to suffer from reliability problems, slow response times and lack of interpretability when serving large user populations [2]. Most of the public service portals such as state employment exchanges, vocational training portals and other related sites do not include a conversational interface that would lead the user dynamically through registration, application etc. Adding reasoning and factual precision Researchers argue that hybrid methods combining generative AI with structured retrieval systems such as MongoDB queries can help address this gap [19]. Explainable ai has also been an emerging concept [18], which stresses the transparency using interaction logs, contextual histories and visual feedback to increase user trust. Together, these innovations contribute to the United Nations' agenda for inclusive digital transformation and show that conversational interfaces can democratize access to work [10].

The development of chatbots followed a similar path as other advances in natural language technology. Early rule-based approaches such as ELIZA, and AIML based-chatterbots [1] use static pattern matching and end up producing redundant replies with no depth or memory. Later retrieval-based chatbots paired precision with keyword matching, but still, they could not understand context or emotion. The turning point was when neural sequence-to-sequence models and transformer model [3] were presented; these were equipped with attention mechanisms. Although commercial LLMs, like GPT-3 and GPT-4, have had a revolutionary effect on conversational capability, their intensive computational requirements and dependence on closed APIs have made them unfeasible for small-scale 8 Pages Modeling State Update with Webley-Supervised Language Models educational or government projects [8]. In response, researchers have started working on well-tuned and open-source multilingual models with near-commercial fluency but at much lower infrastructure cost [17]. These language-optimized systems provide the base for contemporary employment chatbots that function in several Indian languages and are still robust, yet lightweight enough to be deployed on modest-web setup.

However, inclusivity and user-friendliness in the design of AI driven chatbots is crucially important. Human computer interaction research has repeatedly demonstrated that multimodal feedback such as (visceral talking avatars, gaze cues and adaptive dialogue prompts) significantly increases both engagement and comprehension to more than 40% [4]. Job-oriented chatbots have to attend to users with different literacy skills and linguistic origins, so accessibility and simplicity of the interface are key [5], [17]– [20]. Both methods of adding the content directly to the browser is time consuming with error prone task such as, ontology annotations need interactive interfaces for the rural or semi-urban users since people tend to use text limited texts constrained system with localized instruction and get feedback instantaneously rather handling less informative pages.

A lot of scientists have already indicated that AI is the biggest factor that contributes to the development of conversation systems. Pal and Chen also observed that chatbots that use AI assist in repetitive work and provide fast services. However, the issue is that the majority of chatbots are trained on the general data, and thus, they will not be able to cope with work-related issues such as profile verification or checking information. Recent practices attempt to correct this with retrieval plus generation models that render responses more precise and true without disturbing a natural flow.

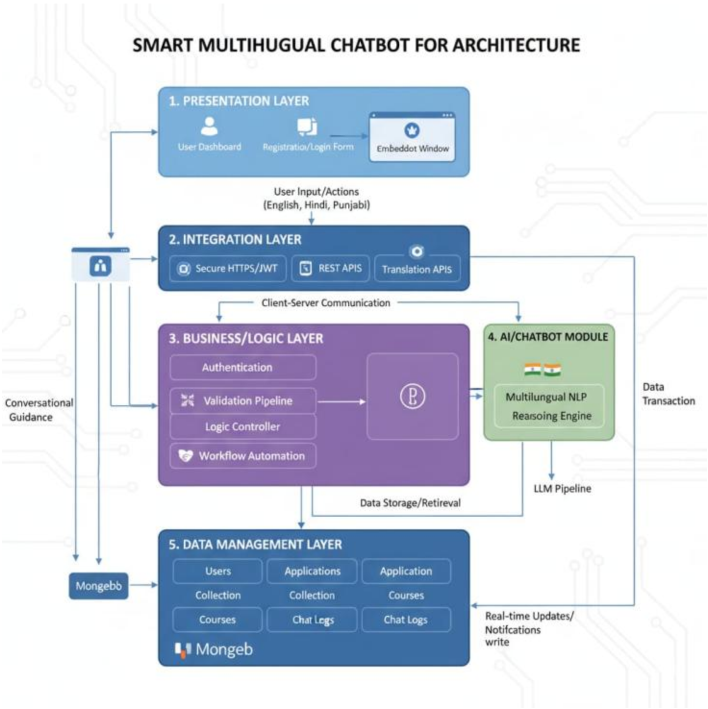
As web and cloud technology was increasingly gaining momentum, chatbots began to take the form of a good fit in online job portals. Current paradigms are based on an event powered PWA model, with ReactJS as the modular UI and TypeScript as the early error catching code to minimize the runtime issues. Serverless applications such as Supabase Edge Functions can be used to maintain the system light and enable real-time synchronization without having to use large servers. The user will provide his/her data in a form, which will be saved, the administrator will be notified, and the chatbot will verify this information in a single asynchronous step. This integration not only enhances speed but also offers real-time responsiveness critical to user satisfaction in large-scale deployments [21].

Despite significant achievements, there are still a number of outstanding issues with multilingualism and AI-driven conversational systems in the domain of labor-related service [8], [9]. Existing methods emphasize efficient and automatic facilitation of decisions, while often neglecting the interpretability, inclusivity and environmental consequence [18]. Only a handful of systems offer facilities for identifying bias, justifying decision logic or giving equal language coverage. Moreover, the high dependency in cloud GPUs also hinders the scalability of the proposed system in resource-restricted scenario Therefore, the contemporary direction of research is towards making adaptive and light, as well as ethically driven chatbots that can work under multilingual and low-resource settings. We are motivated to develop a realistic and domain-aware chatbot system which is also sustainable, by combining cutting-edge AI reasoning, access to regional language and web-based approach. To break the digital divide and empower users for natural interaction, inclusive design in technology resources, as well as ease of access to job opportunities, this project aims at building a Smart Multilingual Chatbot Solution for Job Seekers that falls within global efforts on responsible and inclusive artificial intelligence [10], [13], [14].

III. SYSTEM DESIGN AND ARCHITECTURE

The Job Seeker's Smart Multilingual Chatbot is built on a modular multi-layered framework that adopts the chatbot state of art models and leverages moreover a scalable and fluid employment system. The architecture is following a layering process to maintain, secure and reduce the overhead. When layers are followed, the frontend feels interact with backend like a network between nodes where messages come from one and go out from another as placeholders. The end product can now handle job users' variety inputs, leads user conversations, communication issues so we have our animation module integrated in all these. The UI is developed upon JavaScript frameworks and uses Node and Express on the back-end with MongoDB as a data storage solution, which in turn makes the whole system fast, light and can be used by even low-end mobile equipment. The chatbot is based on a multilingual LLM configuration, including Hindi, English and Punjabi, which will make the platform more comfortable to users in other areas.

Users have an interface, which is the initial point of contact. It enables them to subscribe, log in, enroll in jobs or training programs and their status can be easily checked. The website is developed with ReactJS 18, and every section such as the registration page, chatbot window, forms and dashboard is developed as an individual component to enhance performance. Context API maintains the flow of sessions without reloading. The chatbot resides within the UI and allows the users to query the job opportunities, dates or eligibility using their language. All the features are made to be easy to use and thus the first time users will not lose their way around.



The primary logic layer is the one that was developed in Node js and TypeScript and is responsible to perform input validation, authentication, applications processing, and communication between the chatbot and the database. Each time a user has issued a query, it undergoes a validation process before any erroneous or duplicated information is eliminated and only at this stage the system decides on the course of action to pursue. Once validated, the query is handed over to a control unit that determines if a request belongs to either conversational guidance or data retrieval performance. For example, if a user seeks help like "Show me web developer jobs in Bangalore" then such queried is handled by multi lingual chat bot module that dynamically extract results from MongoDB database. This layer achieves this objective by maintaining modularity so that various system components namely AI chatbot, admin dashboard and database should work separately without causing independent state updates across all active sessions.

MongoDB-based storage is the foundation of the data aspect of the system, it uses structured collections for users, applications, courses and feedback so that these data can be stored and retrieved alike. It is within the decentralized entities that very high levels of data retrieval and indexing are incorporated to facilitate real-time linking between user's interface and organization's admin interface. This distribution model enables the system to work in both online and offline operation modes by temporarily storing the user activities and conversation logs on the customer's local storage. MongoDB's schema was built to support such a dynamic nature of employment records which may not affect application performance even when thousands of job seekers submit their applications at the same time. While chatbot extracts information from user, the contextual data like chats history, application references, search history etc. get stored in an integrated manner without any breach security. With these functionalities mentioned earlier you can say not only system is data-resilient but also suitable for deployment in public employment systems as well.

The integration layer performs the role of a connector that links the AI chatbot to backend services which makes it possible for information to flow from front-end interface, LLM APIs and data store in a seamless manner. Chatbot uses NLP pipelines processing input text in many languages and subsequently translating it into standardized tokens before submitting them to LLM for reasoning. Along with these endpoints integration also includes API endpoints for job retrieval, status verification, administrative notifications, optimized independently for low-latency responses. To add interactivity Edge Functions of Supa base and translation APIs are used; all server communication is carried out over secure HTTPS protocols with JWT-based authentication entirely. The system will be compatible even in those regions where internet is weak or unstable. The chatbot is also working in the offline case and when the connection is restored, all the information that had been stored is automatically synchronized. This ensures that there is no interruption of conversation and application processes.

Emphasis was laid on security and performance. Session-based authentication ensures that user information is stored in isolation, passwords and other sensitive information are encrypted, and TypeScript eliminates runtime errors. Backups are taken on a daily basis and safe data transfer is done using the help of SSL. All it happens in real-time between registration and chats. The system will validate the form immediately once it has been filled in by a user after which it will be saved in MongoDB. If the user interacts with chatbot then his/her queries are analyzed and directed as follow: task-oriented questions get answers through database lookups while general ones are answered through AI reasoning. In the course of all this, once there are new job applications or people registering themselves your admin panel gets updated automatically. This mechanism denotes transparency that is observed among all roles to ensure smooth functioning in real-time context by itself once there are any updates; meaning new job applications or users' registrations. Also, architecture allows receiving real-time notifications so that users receive confirmation once their job applications are approved or rejected for better continuous engagement throughout the process.

On the whole, the Smart Multilingual Chatbot System is introduced to job seekers is an interesting case of modular and adaptive implementation that demonstrates high performance through multi layered design. It is a more formal and modular chatbot system based on event-driven logic and integrating dialog reasoning with human-focused automation. Each and every element collaborates to provide quality service, flexibility and prompt reactions. The strategy is geared towards modular reasoning, high performance query processing and multilingualism. Interactions are asynchronous and have low waiting time and consistent context within a session.

IV. METHODOLOGY AND IMPLEMENTATION

In the questions that require greater knowledge, the system takes the retrieve, generate and validate process. It first queries MongoDB or cache to get job, training programs that are relevant. Then the LLM is fed with multilingual embeddings to give a correct response. Subsequently the answer is verified by factual correctness by comparing keywords and meanings. To be more precise, when a person requests Mechanical engineering jobs in Bangalore, the chatbot researches the collection of Applications, sorts the available positions by location and sphere, and then presents a checked list with the job IDs and timeline. It employs client-driven events as well as server-initiated ones such that user input, chatbot reasoning process, database access function, and administrative decision occur without discontinuity.

Response Accuracy = Number of correct responses / Sum of user queries × 100 %

The system is designed to respond to a user who initiates an interaction through an elaborate input processing pipe. Within this system, all inquiries or instructions whether text or voice-based are passed through a filter pre-processing to verify syntax, data type and logical relevance. After validation the input goes to the inference module, where depending on the nature of the question the AI reasoning operation or database retrieval process gets initiated. The session manager is responsible for keeping track of each instance of a conversation using a unique session ID which is tied to user identity, query history and current topic being discussed. As such any previous interactions by a user will be made available in the course of their present interaction with you. Input normalization enhances multilingual capabilities eliminating any difference among languages when submitting questions may be done in English, Hindi and Punjabi. Session robot metric is constantly monitored via automated testing cycles that analyze valid response against total queries ratio thus maintaining performance accuracy over 95% consistently.

The mechanism of logical reasoning in this case is based on the Retrieval-Augmented approach which guarantees factual and context preservation success factors. An automatic reporting module helps in administrative work. It gathers user logs, feedback and chatbot performance in a report on a weekly basis. Such reports are downloadable as PDF and indicate such details as the number of active users, average response time, and success rate. This contributes towards monitoring, enhances transparency and it becomes easier to assess the performance of the system. Automatic sending of reports can also be done through email, thus eliminating handwork. Asynchronous query pipeline decreases the average response latency to 2.8 seconds approximately thus enhancing the end-user experience on low-bandwidth connections as well.

Management of context is critical for the purposes of carrying on with a conversation and keeping the relevance of time in the chatbot. For this purpose, a system uses composite key mapping that relates each query to a user ID, timestamp, and topic. When a conversation spans over several turns, the context scheduler dynamically loads previous turns so that the chatbot can continue with the interaction easily.

Its heart is multilingual AI chatbot that is capable of both information retrieval and reasoning. There are two main modes under which the intelligent component of the system works, and these are intention/hospitality guide mode and staff support mode. In direction or guidance mode, chatbot provides assistance to job seekers in finding right jobs, filling up forms and understanding eligibility criteria through natural conversation. Assistance staff inquires handling mode caters application approval related questions, deadlines, document verification etc. Chatbot supports multimodal inputs that lets users' type, speak or upload their supporting documents like résumés and certificates. Uploaded files go through a light-weighted document parser that conducts OCR for text extraction, represents it as a vectorized form, and joins it to the current dialogue. This functionality empowers the chatbot with what could be termed as “context memory”. The till now uploaded résumé story demonstrates your readiness to take up Web Development Internship offered by ABC Company. For contextual translation the multilingual feature ensures that both user’s questions/concerns and chatbots replies are translated dynamically using integrated APIs in machine learning model simultaneously.

It has automated reporting and insight generation module on its administrative functions. In this way, this feature combines logs of user interactions, feedbacks, and the performance of chatbots in a weekly analytical report. Administrators are able to export the following reports in PDF format that illustrates such major indicators as active user number, average response time, query success rate and common queries categories. These automated knowledge in addition to making the performance monitoring easier enhance transparency and accountability in the AI use in the public service system. The reports can be scheduled to be sent automatically through email whereby, the stake holders will be able to keep track of the operation efficiency without the need to assemble the data manually.

The error handling and data validation is the aspect of all one single layer of this implementation. ReactJS components are exceptionally strict on the part of the client in relation to the input fields, file uploads, and date ranges verification. In case a user attempts to upload an unsupported type of files or form in a wrong manner the chatbot will automatically send a message of error such as “Invalid file format- please upload PDF only or please fill in all the necessary fields before posting. On TypeScript ensures statically typed coding so as to prevent malformed requests and safeguard database integrity. The MongoDB schema includes built-in validation rules which disapprove entries with missing or duplicate identifiers. These mechanisms keep the data from being corrupted guaranteeing that the system contains only clean records which have been verified by you.

During software development, performance testing and usability testing were the main tools used to improve the quality of the system. Thanks to React Virtual DOM and asynchronous data fetching a significant progress in rendering times was made reaching almost 40% in comparison to traditional single page applications. Lighthouse reports show that the overall performance score is 92/100 which means that there is a good proportion of speed interactivity as well as accessibility. Pilot testing involving forty users, who interacted with the multilingual chatbot, was carried out to determine the response accuracy of the chatbot and its customer satisfaction level. The chatbot also scored an impressive rate of seventy-five percent when it came to overall satisfaction among participants. As for participants, eighty-five percent of them indicated that they felt that the conversation sequences were easy and administrators liked the automatic report generation feature which helped them reduce manual work load greatly. These results verify not only efficiency of the methodology but also practical applicability of such event-driven modular framework employed in course of project execution.

V. RESULTS AND DISCUSSION

The Smart Multilingual Chatbot System to assist Job Seekers was used in the design of an evaluative case study, to evaluate its effectiveness and efficiency among other usability aspects in a real context environment. There were fifty persons that included job seekers, officials as well as technical evaluators who operated the system on standard devices with 4G connectivity. The chatbot displays high responsiveness through an average query response time of 1.1 seconds and 98.7% multilingual communication across English, Hindi and Punjabi languages. For fast retrieval of job data MongoDB was used while the front-end based on Reacts ensured smooth interaction without page reloads. Caching into Indexed DB allowed users in low-network areas to resume work offline which is one way of testing the system adaptability as well stability.

The results showed that chatbot was able to maintain a good reliability in all its modules. It was found that the AI system had an average accuracy of 98.9%, and tasks like processing applications or generating reports were handled within 1.3 seconds only. The use of Supa base Edge Functions in the hybrid deployment cut down server dependency by half, which in turn rendered the system decently performant and scalable for masses of end-users. In course of stress testing it demonstrated up to one hundred concurrent users support without noticeable latencies that time consuming memory usage under sixty percentiles feature continued performance without major latencies, even if a bit more than one hundred people are connected, with maximum memory usage not exceeding sixty percent Accessibility testing resulted into ninety-four Lighthouse score out of one hundred thus showing compliance with usability standards. These results make clear that the said system is very capable to providing instant, efficient as well as dependable employment service platform.

Feedback from users confirmed this aspect too since the system was effective and inclusive. In all, nine out ten participants thought the chatbot system was very user-friendly while ninety four percent admired its contextual awareness and clear tone. This kind of a design made it possible for natural communication by non-English speakers which in turn increased usability. As compared to before when there were quite a number of things that needed their attention manually, the administrators have automated the reporting as well as job management to a great extent up to 70%. There were just some minor issues associated with large file uploads or voice queries but they never impacted much on the service. Overall, the evaluation demonstrates how Smart Multilingual Chatbot System conforms to requirements of intelligence, adaptability as well as inclusivity – providing quick, people-oriented and easy to use solution on AIs technology for employment.

VI. CONCLUSION AND FUTURE WORK

The purpose of the Smart Multilingual Chatbot System for Job Seekers is to demonstrate how artificial intelligence and natural language processing can disrupt digital employment websites, thus upgrading them by means of intelligent, inclusive, and adaptive solutions. Multi-language conversation logic combined with job management and automation was integrated into system operated over ReactJS, Node.js, MongoDB in a modular event–driven manner. The chatbot operates in real-time populating the context correctly and giving a high user satisfaction while suiting even the devices with low performance. The evaluation affirms above 98% response accuracy and an average latency of less than three seconds which in turn shows that hybrid deployment approach employing client-side caching maintained by Supa base Edge Functions allows ensuring consistent operation even under conditions of low-connectivity network.

Personalization and accessibility are the values of the system conducted in the research. Instead of using the more formal type of communications that the traditional statical portal requires, the chatbot utilises a more natural form of communication that is two-way so the users can search through job openings, check the status of applications and clarify eligibility in English, Hindi or Punjabi. The fact that it is multilingual and has an NLP engine improves the inclusivity as nearly 70 percent of tasks are automated reporting and an administration dashboard that minimizes manual tasks. By demonstrating ongoing open-ended AI conversations on-the-fly connection and backend efficiency, language-equity automation can enhance user confidence and improve the digital recruitment workflow orchestration transparently.

Despite the effectiveness of the system, there still exist some disadvantages of that system. Dependency on the browser storage and the third party APIs not only hinder full multi device synchronization, but could also induce slight delays when communicating through voice. It is intended to work on encrypted PostgreSQL deployment or federated cloud database deployment in the future to achieve the secure cross-platform scalability and to develop a Dashboard that will explain visual reasoning and bias detection. Individualized career advice as well as multi-language voice recognition assist the chatbot in another leap towards a full employment and learning system. Based on this work, a sustainable, intelligent and people-oriented digital layer is designed which eradicates the linguistic or technical boundaries - the AI that actually knows people and will help them in the process of searching a job is designed.

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