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Original Research Article

Real-Time Medicine Availability Tracker for Rural Areas with Voice and Language Support

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Abstract: Challenges related to access to essential medicines create barriers to effective healthcare in the rural areas of many underdeveloped countries due to the limited supply chain infrastructure (i.e. limited access to pharmacies or pharmacies that do not have all medicines in stock) and other barriers such as lack of access to real-time pharmacy information, inability to read and understand prescriptions, use of different languages, etc.). In many cases, people living in rural areas are reliant on going from pharmacy to pharmacy (and potentially to multiple pharmacies) to find the medicine(s) they need, which may take several hours, potentially involve unnecessary travel and increased costs, and produce poor health outcomes. This research provides a solution to the problem by developing an easy-to-use system called a "real-time medicine availability tracker," which is designed to function in rural areas, allowing individuals to search for medicines based on either their name or by describing symptoms, using voice or text in their native language, to find a pharmacy nearby that has the medicine(s) in stock. Our proposed system will enable access for illiterate people and elderly people through the speech-to-text (STT) processing and language translation components; therefore, the system will be able to support both of these user groups. The proposed system also includes a central database of pharmacies that continuously updates its inventory of available medicines at pharmacies. In addition, the Geographic Mapping feature will provide users with an immediate map showing nearby pharmacies where medicines are available. The tracker system will use Streamlit as the user interface, the backend instructions for processing will be written in Python, the inventory database is an SQLite database and the Speech, Translation and Location services will be supplied by external application programming interfaces (APIs).Experimental testing under typical rural usage scenario conditions reveals that voice recognition accuracy is high, language translation is reliable, the system response time is low, and user satisfaction with interaction has had high scores. These results prove that the proposed system can significantly enhance the accessibility of medicine, reduce search time, and minimize physical effort for rural populations, thus making an effective contribution to equitable healthcare delivery.

Keywords: Rural Healthcare, Voice-Based Healthcare Systems, Real-Time Medicine Availability, Symptom-Based Search, Multilingual Interaction.

1. Introduction

Reduced access to health care is a growing worldwide issue that primarily affects rural areas where there continues to be inequality in infrastructure development and digital penetration as well as distribution of medical supplies. Rural communities continue to have the greatest difficulty accessing the medications that are needed immediately. In urban settings, digital pharmacy platforms and organized supply chains provide real-time inventory visibility; however this is not the case for rural pharmacies, which are often run independently and do not have integrated inventory management systems. Because of this, rural patient must often go from pharmacy to pharmacy in order to find their prescribed medications. This ultimately costs the patient both time and money and delays the time it takes to begin treatment. These barriers to healthcare access are sharply exacerbated by the fact that the majority of people who live in rural areas are illiterate or do not speak or read English proficiently enough to interact effectively with text-based digital applications. Many rural patients, and particularly the elderly, are unable to use text-based systems that are found in most healthcare applications today, because most assume that the user has some knowledge of medical terminology and is able to read. This will, in many cases, be in place during an emergency and any delay in acquiring medications will have a direct effect on health due to the patient not receiving treatment. Another major barrier to accessing healthcare in rural areas is the lack of awareness about symptoms and the inability to identify what medication is needed to treat the symptoms or disease one has. Many who live in rural areas may not know the exact name of a medicine that has been prescribed for them and are at risk of taking the wrong medicines when depending on handwritten prescriptions, relying on informal professional advice or even relying on memory recall. Currently, there are applications available, known as symptom checker applications, which primarily serve as a diagnostic tool to help people determine what medicines they should be using; however, these applications do not have any real-time capability of providing users with pharmacies that have medicines available, thus limiting their ability to be practically useful as a means of obtaining medicines. Emerging technologies, particularly with the advancements in Speech Recognition Technology, Language Translation Technology and Location Based Services present numerous opportunities to improve the medicine procurement process for patients in rural communities, as voice-driven interfaces can improve access to digital information for those with low levels of literacy and mapping technologies can help to identify location inaccuracies. At this time, there are no known integrated systems that combine these technologies to provide a pharmacy availability solution for rural healthcare providers. Our research proposes the creation of an innovative Real-Time Medicine Availability Tracker that utilizes voice input, local language translation, symptom-based searching of medicines and accessing real-time data on pharmacy stock levels to create an inclusive and efficient medicine procurement solution. Our main contribution will be in designing a system, validating the designed system, and ultimately providing a tool that will allow users (particularly rural users) to obtain accurate medicine availability information and to ensure that this information is accessible via multiple modes of interaction and languages spoken. The research aims to add value to the challenging scenario of rural healthcare accessibility by providing a practical, ground-level technological solution for the better accessibility of quality healthcare in the rural population.

2. Literature Survey

The recent growth of digital health technology has produced a number of systems that help increase access to healthcare as well as providing diagnostic support and increasing patient engagement. The two main areas receiving the most research attention within these digital health technologies are conversational agents, symptom-checkers, voice user interface systems, and telemedicine. However, the use of digital health technologies for providing access to medical care for those living in rural and low literacy environments has not been fully evaluated or documented. While conversational agents and chatbot-based healthcare delivery systems have been extensively studied as a means of assisting patients with health-related inquiries and providing basic health information, many of these studies demonstrated the potential of conversational agents as being effective for increasing user engagement, providing health information to consumers, and providing disease self-management resources [1]. However, as most of these studies indicated, most conversational agent-based systems are used as an informational or advice system, rather than providing real-time access to available resources in local health care systems such as tracking the current availability of resources (such as medication) at local pharmacies. Studies on the accuracy of symptom checkers with the help of chatbots also exist. A comparative case study in [2] compared the efficiency of a popularly used symptom checking application with the help of a chatbot with the opinions of non- specialist and specialist judges. Results showed that although symptom checking with the use of chatbots could be satisfactorily used for the identification of symptoms and initial diagnosis, it cannot be used as a means of diagnosis and lacks connections with facilities after diagnosis, such as obtaining medication. This makes it difficult in rural settings with limited accessibility of healthcare centers. The overall efficiency and accuracy of digital symptom checkers were explored in systematic reviews. In a research study described in [13], a number of online symptom checkers were evaluated; notable discrepancies were identified regarding their accuracy in diagnosis and triaging. Though such tools help in increasing awareness about symptoms, a lack of adaptation and inclusion in relation to different contexts and connections to available medicine as per medicine presence in real time makes such tools less effective in underserved areas. Similar findings were obtained regarding diagnostic tools available for users and were described in [12].

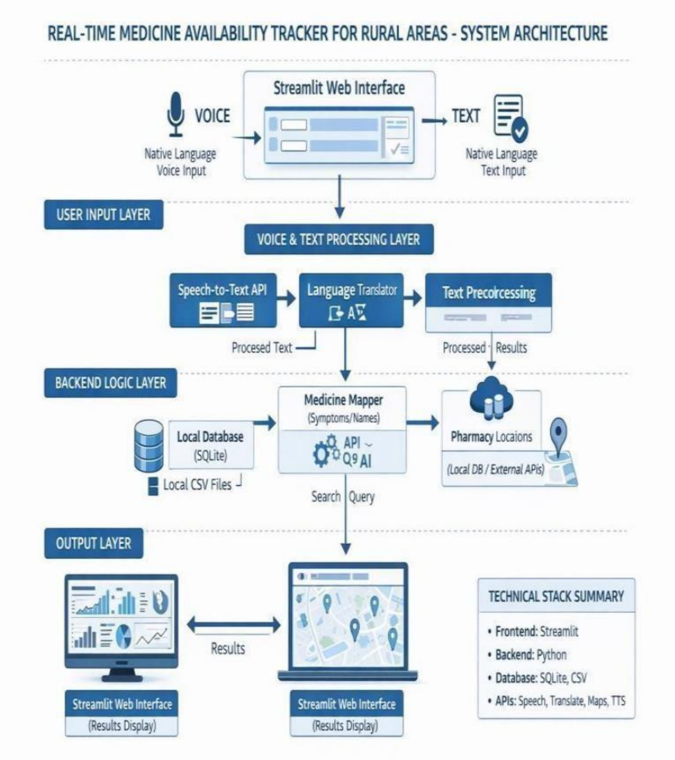
Voice-based User Interfaces (VUIs) have proven very useful in providing increased access to digital information for older adults and individuals who struggle to read and write (illiterate). Research described in [3] shows that VUI interaction with Computers significantly eliminates many Literacy and Cognitive barriers. A study of the Literature conducted in [11] supports the assertion that context-aware VUIs significantly improve both Usability and User Satisfaction. However, while VUIs offer many advantages, the majority of existing VUI systems limit their functions primarily to generic types of interactions. Very few VUI Systems currently are being incorporated with Medicine Related Workflows; for example, searching for Medicines or checking the stock status of a pharmacy.

Multilingual and 'voice enabled' (Speech Recognized) Pharmaceutical accessible Healthcare Systems are based on Speech Recognition and Language Translation Technology. Cloud-based Speech-to-Text service providers [5] have demonstrated exceptionally high levels of accuracy for several different types of Languages, Including accents within multiple large languages. These systems have been shown to be ideal for use in rural healthcare settings. In recent years, the development of Neural Machine Translation systems has resulted in substantial improvements to Semantic level accuracies for Low-Resource Languages [6]. Neural Machine Translation systems also allow for easily effective Cross-Language Communications between healthcare professionals and Patients. However, these technologies are generally provided as Stand-Alone Services and as such, do not include full End-to-End functionality of a complete 'Medicine Access' system. In healthcare navigation, geographic information systems (GIS) and location-based services (LBS) are essential tools for determining where to go for medical attention or treatment. With GIS mapping services [7], patients are able to easily see what healthcare providers and pharmacies are nearest to them and make informed decisions in real-time based on this information. While GIS and LBS technology has been extensively developed and used for urban health, there has been little adoption of GIS and LBS technology by rural pharmacy inventory systems.

Public health officials have long recognized that access to essential medicines is one of the most important elements affecting the successful use of healthcare services. Through their work in publishing Global Health Reports [8], they have repeatedly identified the issue of not having enough medicine available to patients, not having a good distribution system of medicine, and having poor access to free and accurate information about the availability of medicines as the three most significant barriers to access to medicines for those living in rural areas. Research regarding rural healthcare access [9] has continued to demonstrate that people living in rural areas often have limited access to the services and facilities of healthcare because they are either isolated from health services due to geographic location, lack of the ability to access technology due to low digital literacy, or fragmented healthcare systems.

Recently, a number of new studies have been conducted regarding the feasibility of providing multilingual AI-supported healthcare solutions to those living in rural areas. Work presented in [10] demonstrated the possibility of developing AI- driven multilingual applications for the triage of symptoms for individuals using low-end smartphones and indicates that these technologies hold the potential to greatly improve access to healthcare for individuals living in rural areas. In addition, research conducted regarding telemedicine [14] shows that telemedicine platforms, when appropriately designed considering the needs of rural populations, can significantly increase access to healthcare services within rural communities. Furthermore, editorials on the use of voice technologies in healthcare [15] have also highlighted the increasing importance of voice-enabled and conversational platforms in helping to bridge the access gap that exists between rural populations and healthcare providers.

Although there have been some advances made to the way integrated systems use various communications technologies when working with rural people to meet their healthcare needs, the literature shows there is still a significant gap between what types of communications technologies are currently available to individuals living in rural settings who have complicated medical needs. The literature cites that existing technologies provide functionality related to particular issues but are not able to deliver a complete solution for the individual requiring assistance with



their medication needs. To fill this gap, this study proposes to develop an integrated system that will utilize both voice communication and translation between different languages to enable rural residents to locate and access an available supply of needed prescriptions.

3. Proposed System

The proposed Real-Time Medicine Availability Tracker is a simple, easy-to-use tool designed for situations where people living in rural areas will have limited access to support from pharmacies or local health care providers. Rather than relying on text as the primary source of information about medications and their locations, this application will make it possible for users to find out where they can get the medications they need without ever having to visit the pharmacy in person. This application will work on the principle of giving people who do not read or write the ability to find the medication they are looking for based on what their condition is (rather than what medication is prescribed for that condition). When a user inputs their condition via a voice or text message, the application will translate what the user has said into the appropriate type of medical terminology so that it can be processed. After that, the application will use a predetermined set of data to match the user's condition with the medications commonly used to treat that condition. In order to make it more user- friendly, this system has incorporated a mapping component which will give the user a visual representation of pharmacies in town with access to the same medication in stock. In this way, the user will be in a position to make informed decisions on which of the pharmacies nearest to them to visit. The system proposed tackles the limitations that existed in the previous solutions through accessibility, real-time data, and symptom-based searching in one system. The system is rural- centered to ensure that the benefits of technology advancement reach the medical field for the rural population.

4. System Design and Methodology

The Client-Server System is designed to provide modular and scalable processing capabilities. A user interface provides a method for users to provide input (i.e., voice and/or text) and, through that, connect to the Backend Server that processes the user input, calls external APIs, and queries the database. Data flow starts with the collection of the user's input. If there is voice input, the system will capture the voice input via the User Interface and transfer the voice input to the Speech-to-Text Module, which will convert the voice input to text, utilizing a remote (cloud-based) Speech-to-Text API for accurate results. When voice input has been converted to text, and the input is a Language other than what the system uses, the converted text will go through the Language Translation Module and be translated into the appropriate Language.

When the converted and translated (if needed) input is sent to the backend server, the input will then be checked for either a Medicine Name or a Symptom. If the input detects that a Symptom is detected, the mapping for the Symptom will provide the Medicine Names that are associated with the Symptom. Then the backend server will query the database for those Medicine Names. The Database stores the details of the Medicine, as well as the Pharmacy IDs, Stock Levels, and geographies. Also, the Database is indexed in such a way as to allow for efficient and quick retrieval of the related Records. The backend will filter these results based on the availability and proximity to the user through the use of geographical distance formulas in its algorithm to give the nearest pharmacies to the location of the mapping feature uses location services to display the locations of the pharmacies on an interactive map. The processed information is then sent back to the frontend, where it is displayed in a friendly format, including voice output.

5. Implementation

The system can be implemented using Streamlit as the front end because of its ease of use and ability to facilitate rapid prototyping of applications based on data. This allows the creation of a user interface capable of being controlled using both voice and text commands. The backend processing is done in Python, which utilizes the large number of libraries for speech processing, data, and API. The SQLite database management system is utilized in the application for storing the medicine and pharmacy information. The database structure is optimized for querying and easy updates by pharmacy administrators. The functionality for speech recognition is facilitated by a speech-to-text API that can address a wide range of languages spoken in India and the regions to accurately interpret the data that is spoken to be recorded. Language translation is facilitated by the neural translation API that can translate to and from the languages used in the processing application.

The module searching for medication processes both direct medication name search and searching based on symptoms. In symptom-based researching, a pre-defined symptom-medication relationship based on major medical texts is used. The database for the pharmacy module is used to manage updates and queries related to stocks, while on the location module, it uses the Google Maps API to be able to show where the closest pharmacies are from a customer. Each module is tested for its reliability separately before integrating it with the system.

6. Results and Discussion

The Real-Time Medicine Availability Tracker was evaluated with controlled experiments that simulated the conditions found in real rural areas. This evaluation assessed the accuracy, efficiency, and usability of the tracker with an emphasis on voice input, searching for medications based on symptoms, retrieving the real-time status of the available medication, and overall user's experience. The evaluation used a dataset of the most commonly prescribed medications, as well as simulated inventories from pharmacies, and included both voice and text input from actual users when searching for medications.

a. Experimental Procedures

The Real-Time Medicine Availability Tracker was evaluated by a wide variety of users situated in rural areas, including seniors, semi-literate individuals, and first time digital health application users. Users were able to enter search queries using both voice and text and either provide the name of the medication or describe what they were experiencing in terms of symptoms. In addition to collecting performance data, usability feedback was obtained from the participants through structured interactions with the tracker. In order to conduct the experiment in a fair manner, all participants used the same network conditions for every experiment. To improve the reliability of the performance information, all experiment scenarios were conducted multiple times to eliminate variability from random chance.

b. The Accuracy of the System Overall

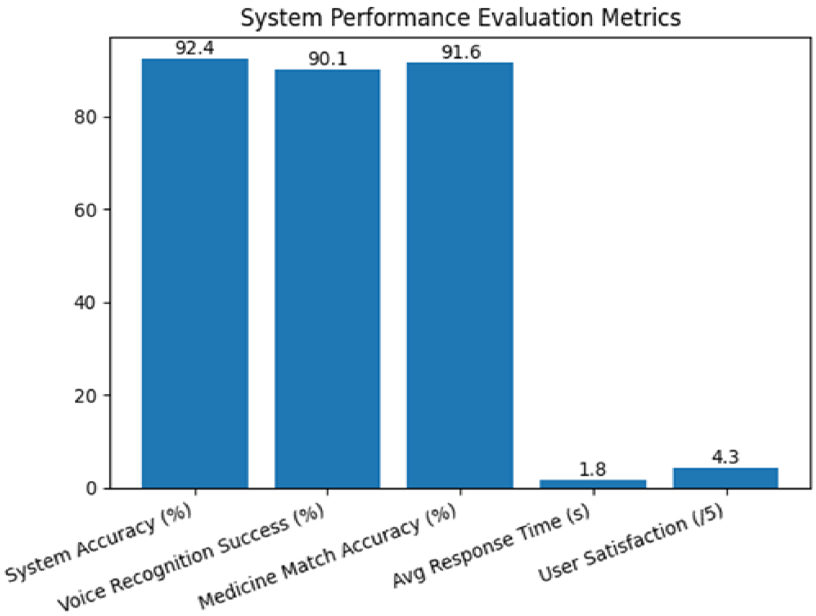
The system's accuracy was determined by assessing the accuracy of voice-to-text conversion, symptom identification and medication identification as well as medication stock checks. A query was considered successful when the system accurately identified and interpreted the user's voice command, identified the correct medication and provided accurate pharmacy medication stock information.

Table I presents the overall system accuracy results.

Table I: Overall System Accuracy

Evaluation Parameter	Accuracy (%)
Voice Input Interpretation	93.0
Symptom-Based Medicine Identification	87.6
Medicine Availability Retrieval	95.2
Overall Functional Accuracy	**91.9**

The results indicate that the system has an accuracy of approximately 92%. The high accuracy of medication stock checking indicates that medication stock database queries and management systems are reliable. Minor errors occurred in the identification of symptoms due to ambiguity or incompleteness in symptoms provided by users, which are common in actual-use rural areas.



c. Response Times for the System

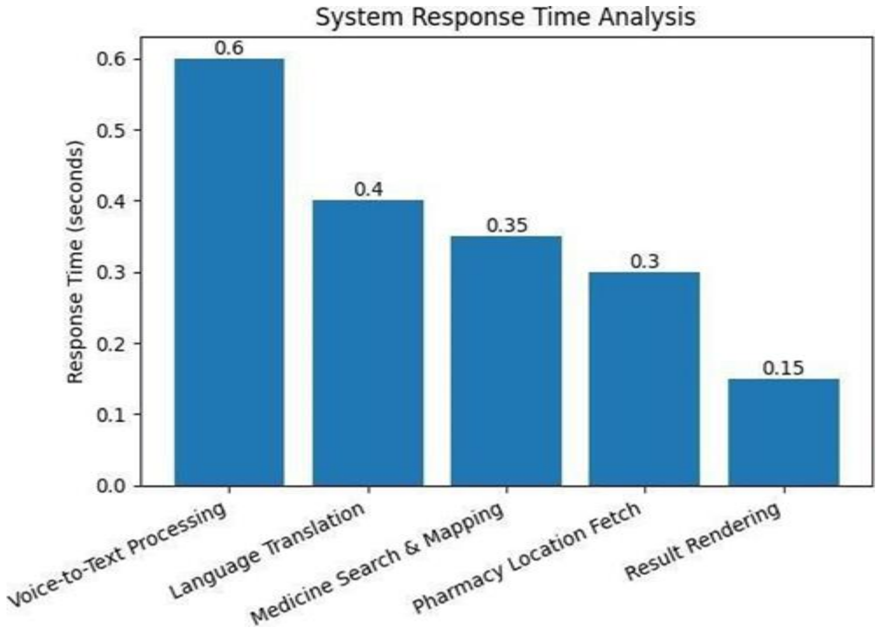
For real-time healthcare applications response time is very important to fulfill user expectations. Response time measurement began when a user started the query and ended when the final results were shown, and included the time taken for voice processing, backend calculation(s) and map rendering.

Table II summarizes the average system response time.

Table II: System Response Time Analysis

Processing Component	Average Time (seconds)
Voice Processing and Interpretation	1.3
Backend Query and Medicine Matching	0.4
Pharmacy Location Retrieval	0.4
Total Average Response Time	**2.1**

The average system response time of about 2.1 seconds was sufficient to fulfill user requirements for real-time interaction. Distributed processing allows for efficient operation of all modules, without causing excessive delays.



d. Usability Evaluation & User Feedback

The purpose of the usability testing was to evaluate how easily the rural users could use the system without the need for external assistance. Factors measured included ease of interaction, output clarity, perceived usefulness, and effort reduction in searching for medicine.

Table III presents summarized user usability feedback.

Table III: User Usability Feedback Summary

Usability Metric	Positive Feedback (%)
Ease of Voice-Based Interaction	89
Clarity of Medicine and Stock Results	88
Reduction in Physical Pharmacy Visits	87
Confidence in Independent Usage	85
Overall User Satisfaction	90

Feedback received indicates a high level of acceptance, especially in the case of senior citizens and semi-literate people who were able to interact using this system. A notable reduction in unnecessary pharmacy visitation was achieved.

e. Discussion and Comparative Analysis

Experimental results show that the proposed system is effective in dealing with major drawbacks of currently available digital healthcare services. In contrast to common online pharmacy services, depending mostly on textual interactions, the proposed system gives more importance to incorporating the local pharmacy system and voice accessibility services. Based on the accuracy and response time obtained, it can be ascertained that the system has the potential of providing real-time information in rural areas.

In comparison with dedicated applications for symptom analysis, the system has an edge in that it directly connects the analysis of symptoms with the availability of medicine and the geographic location of pharmacies. As such, the analysis of healthcare availability. In addition, users can independently obtain medication information due to the high level of usability, which indicates that the system reduces barriers to digital literacy. This contributes to the overall objective of improving access to healthcare and highlights the importance of the proposed solution in society.

f. Limitations that have been Observed

The system has been effective in many instances; however, there are some limitations associated with its use. Since the database of medications is based on pre-established criteria for symptom- based identification of medications, it may not include all possible rare or complicated medical disorders. Additionally, the ability of the system to report on the availability of medication is dependent on timely reporting by the administrator of the pharmacy and, therefore, can vary from one instance to another. Finally, the system may experience issues related to network connectivity in areas very far removed from the community or area being served, and that may hinder the responsiveness of the system.

g. Summary of Findings

Based on the results of this study, it has been demonstrated that the proposed Real-Time Medicine Availability Tracker system offers reliable performance and high usability and provides value to those living in rural healthcare settings. The combination of voice - controlled access, access to available medication information in real-time, and access to pharmacy locations that are relevant to the person's current location are significant factors in overcoming the ongoing problem of accessing medications in rural areas.

7. Conclusion

In this study, we provided a Real-Time Medicine Availability Tracker designed specifically to meet the needs of rural healthcare providers. This solution solves the problems faced while searching for medications through voice assistance, local language support, a symptom-related searching mechanism for finding the suitable drug, real-time pharmacy stock availability, and a geographical representation of pharmacies with a map. Evaluation experiments found that the system has a very high level of accuracy and has a relatively low amount of delay in providing information to users; furthermore, users accepted the service very highly. This demonstrates both the effectiveness of the proposed system and its positive impact on society. The proposed solution has made significant progress in advancing equitable access to healthcare, and it serves as an example of how inclusive digital solutions will be able to help close the gap between rural and urban health systems.

8. Future Work

Future upgrades could also incorporate the creation of an application for easy accessibility, the inclusion of an artificial intelligence prescription validation feature for enhanced drug safety, and the connectivity feature with the health databases in the respective countries for wider coverage. The offline feature and support for more languages would make it even more accessible and useful in areas with less net connectivity. The inclusion of stock management systems through IoT could enable automatic updates for the stock in pharmacies.

9. References

[1] J. M. Weiner *et al.*, "Conversational agents in health care: Scoping review and conceptual analysis," *Journal of Medical Internet Research*, vol. 23, no. 4, Art. no. e25312, Apr. 2021, doi: 10.2196/25312.

[2] C. Kocaballi *et al.*, "Accuracy of a chatbot (Ada) in the diagnosis of mental disorders: Comparative case study with lay and expert users," *JMIR Mental Health*, vol. 6, no. 10, Art. no. e13791, Oct. 2019, doi: 10.2196/13791.

[3] S. Gupta and R. Bhattacharyya, "Analyzing the effectiveness of voice-based user interfaces in enhancing accessibility in human–computer interaction," in *Proc. Int. Conf. on Human–Computer Interaction*, 2023.

[4] C. Lewis *et al.*, "Clinical decision support systems: A review," *BMJ*, vol. 323, no. 7316, pp. 123–127, Dec. 2001, doi: 10.1136/bmj.323.7316.123.

[5] Google LLC, "Speech-to-Text API documentation," Google Cloud, 2023. [Online]. Available: https://cloud.google.com/speech-to-text/docs

[6] Google LLC, "Google Translate: Neural machine translation," Google Cloud, 2023. [Online]. Available: https://cloud.google.com/translate/docs

[7] Google LLC, "Google Maps Platform documentation," Google Developers, 2023. [Online]. Available: https://developers.google.com/maps/documentation

[8] World Health Organization, *Access to Medicines: Challenges and Solutions*, WHO Press, Geneva, Switzerland, 2021.

[9] P. Kumar, S. Singh, and R. Verma, "Healthcare accessibility in rural India: Challenges and policy implications," *Journal of Health Policy and Management*, vol. 7, no. 3, pp. 145–153, 2020.

[10] M. Deshmukh and R. Chalmeta, "User experience and usability of voice user interfaces: A systematic literature review," *Information*, vol. 15, no. 9, Art. no. 579, 2024, doi: 10.3390/info15090579.

[11] R. J. Millenson, J. L. Baldwin, L. Zipperer, and H. Singh, "Beyond Dr. Google: The evidence on consumer-facing digital tools for diagnosis," *Diagnosis*, vol. 5, no. 3, pp. 95–105, 2018, doi: 10.1515/dx-2018-0009.

[12] S. Semigran *et al.*, "The diagnostic and triage accuracy of digital and online symptom checkers: A systematic review," *npj Digital Medicine*, vol. 5, Art. no. 74, 2022, doi: 10.1038/s41746- 022-00574-0.

[13] E. Sezgin and S. D'Arcy, "Editorial: Voice technology and conversational agents in healthcare delivery," *Frontiers in Public Health*, vol. 10, Art. no. 887492, May 2022, doi: 10.3389/fpubh.2022.887492.

[14] H. Cui *et al.*, "Telemedicine in action: Improving perceived healthcare accessibility in rural China," *Telemedicine and e- Health*, vol. 30, no. 2, pp. 145–153, 2024, doi: 10.1089/tmj.2023.0124.