# An Exploratory Study on the Use of AI Technology in the Health and Education Sector As A Tool to Increase Efficiency and Diagnostic Accuracy

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## ABSTRACT

*This study is a clear indication of the use of mobile technology to solve various issues faced by underprivileged respondents in developing South Asian countries. This paper specifically looked into a lack of medical assistance to the privileged (₹20,000 or above per month) and the underprivileged (₹20,000 or lower per month). The application (app) was an important tool for them to obtain the correct medical advice within the vicinity where they lived. As the app was available in many languages3, it became easier for the respondents to indicate their ailments. There were genuine concerns that were suggested by the respondents which would be incorporated given time and money.*

**Keywords:** Artificial Intelligence, Illiteracy, Medical Aid, User Interface, Accessibility, Data Science, Telemetry, Underprivileged, Application, and Large Language Model.

**Research Question:** How has the adoption of assistive technology helped rural, underprivileged, or illiterate citizens receive adequate healthcare in countries such as India and Nepal? Additionally, what measures can be taken in accessibility technology with the use of artificial intelligence to increase user adoption and satisfaction?

## 1. Introduction

Artificial Intelligence is considered the fourth industrial revolution that is emerging in the world. The first industrial revolution took place in the 18th century with the industrialization of Britain. The second took place with the adoption of steel and moving to mass production. The third happened in the 1950s with the adoption of computer technology and digitalization. The fourth is the 21st-century revolution concerning advanced analytics, automation, and advanced manufacturing technology. These can be applied along the value chain in the following manner:

1. Connectivity, data, computational power, cloud technology, the internet, blockchain, and sensors.

2. Analytics and intelligence, advanced analytics, machine learning, and artificial intelligence.

3. Human-machine interaction, natural language processing, virtual reality and augmented reality, robotics and automation.

4. Advanced engineering, additive manufacturing, 3D printing, renewable energy, and nanoparticles.

All of the above require workers to be equipped through upskilling and reskilling. Upskilling is still easy as it involves learning new skills to your existing set, but reskilling is the main challenge where workers would need to be retrained with new skills that enable them to fill different positions in their companies.

**Human-machine interaction, natural language processing, Interactive Voice assistants, AI Models, and Voice Technology.**

**2. Requirement of the features and necessities of an accessible application (app)**

Accessibility features are designed to help people to use technology more easily. Some of the main principles that are required to create an accessible app are:

1. Perceivable

2. Operable

3. Understandable

4. Robust

5. A balance between functionality and usability(The app users should want to come back again and again)

Further research on apps specific to illiterate and physically challenged people has led to certain essential factors that need to be carefully considered. For those with disabilities, the app should be clear and should have identifiable images. Icons need to be used. Minimum changing of color should be adopted. The app should not have very fast movements. Along with all of the above, adding text to describe the image would be desirable, especially for those with visual disabilities.

Real accessibility is when the needs of the users with impairments are considered. This may require narration of the contents of the app simultaneously with text and visual images. The idea is to use this app for people of all abilities. If it has to be universal, then most of the features should be adequately modified. The modification will depend upon the initial sample that has been taken to understand the nature of the respondents using the facility. This could be concerning the level of education of the users, language spoken by the users, experience using technology, etc.

If the app is a universal one that is used by both sets of respondents, namely those with specific disabilities and those without. The app should indicate the types of disabilities that it accepts e.g. color blindness, dyslexia, and Photosensitive epilepsy(PSE). These features would have specific ways in which the challenged person could use them. All the features specific to these disabilities would need to be added to the app. Directions for such people would need to be indicated such that everyone is in a position to use these applications.

Language barriers in most apps are addressed by pressing "1" for English and "2" for Hindi which is available in most Interactive Voice Response(IVR) technologies. But in most applications, the process of choosing a language is hidden behind multiple layers of dropdowns, sidebars, and menus.

## 3. Aim of the study

To position the app in a manner that reaches maximum adoption from the targeted group (illiterate and underprivileged audiences).

### 3.1 Definition of underprivileged in the research

Having an income of ₹2.4 lakh per annum or ₹20,000 or lower and if more than one person working the income to maximum go to 3.6 lakhs per annum. This would include the fact that they would have to pay for housing/accommodation, schooling/education, and medical expenses.

### 3.2 Definition of illiteracy in the research

The Definition of illiteracy is an individual who has not cleared secondary education (this includes adults who maybe tenth fail and below) and is an adult.

The study includes methods and ways in which such kinds of individuals could access the applications that have been developed. This would involve educating them to use Android or any other smartphone, downloading the app, and filling up the required forms as honestly as possible. Once they have been educated, they will be in a position to manage on their own.

### 3.3. Development of the App

**3.3.1. The app has been developed using the following technologies:**

- Lamma 3 - An AI model that understands and responds with text (Made by Meta)

    - Fine Tuning - The process of customizing an AI model to one's needs

    - RAG - The process through which a file or document can be understood by an AI model.

- Flutter - A framework to build apps that can work on both Android and iOS (Made by Google)
- Expo - A tool that allows hosting of an application's code to be provided to the Google Play Store.
- Node JS Lambda Functions - A tool to store protected backend code and run it on command as well.
- Postgres Database - A place to store user data and query it later
- Supabase Authentication - A kit to authenticate a user and make them log in through a mobile number and OTP
- JWT API Authentication. - A technique to verify if a user is authenticated or not.
- Deepgram STT - An AI device to convert speech to text to understand user input.
- Whisper TTS - A tool to convert text to speech to make it understandable for users.
- Google Places API - A catalog of all places registered on Google.
- Google Translate - A technology to translate text from one language to another.

**3.3.2. The reason for the use of this technology was to incorporate the features that they portray namely:**

- Converting text to speech and vice versa.
- Asking an AI model to respond to the user query.
- Fetching data about medical services from Google's database.
- Transliterating means keeping the phonetics of the language the same while changing its script. The app transliterated the names of medical services.
- Displaying an aesthetically pleasing user interface.
- Storing user queries in a database.
- Authenticating that no unauthorized user can make a request.
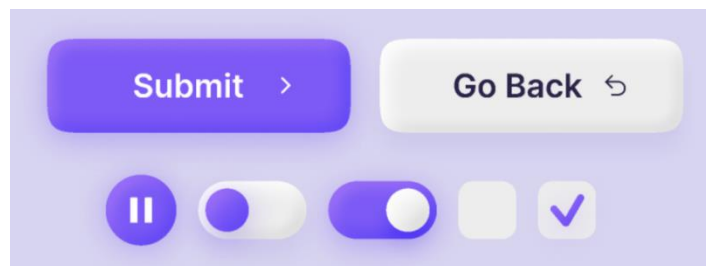- Converting text from Hindi/English to the user's preferred language.

All the factors listed above helped in making the application more robust, workable, and authentic.

## 4. Methodology of making the app

The app required the following features which were incorporated in its procedure. These were:

- Used Clay Morphism (a design pattern that makes digital components look 3D using complex shadows, lighting, and gradients) Design Pattern.

**Figure A:** *Image of Clay Morphism*



*Source:* *https://s3-alpha.figma.com/hub/file/3301384590/7a54e790-18a1-44a4-8083-81554db961d8-cover.png*

- Maintained a Digital Multilingual Dictionary for all the text used in the app as the app required 6 languages to make it credible and far-reaching.
- Incorporated a layer of Google Translate to make content easily readable for all users.
- Used Phone OTP Authentication Method to authenticate and secure requests while preventing DDoS(Distributed Denial of Service) attacks which are a type of cyber attack.
- Introduction Screen to introduce the user to the app and at the same time provide information about its purpose and uses.
- Multilingual Narration - This is an important feature as the type of users were unable to read and write and came from diverse backgrounds in India. For the authenticity of the app and its statistics thus collected, it required the app to be in more languages than just Hindi and English.
- Haptic Feedback: Vibration triggers in an app elevate the sensory experience from just audio and visual to include tactile sensations, subconsciously enhancing the user's digital experience. This engagement makes users feel more comfortable with the app, increasing their likelihood of using it in the future.
- Animations: Moving elements on the app's screen increases its aesthetics, ensuring that the activity being embarked on is pleasant further leading to increased user satisfaction and retention rates.

**4.1 Making and Meaning of the App as indicated in Figure 1:**

**Figure 1: Home Screen**



*Source: Own*

- The logo's font was chosen to blend the primary language of the app, English, with the country's most prominent language, Hindi.
- The flag was used to signify patriotism and how the app would benefit Indians specifically.
- The hamburger menu is used to be familiar with common icon accessibility trends.
- The language panel is to choose the primary language of the user.
- The app features a large red button with a standard microphone icon to indicate that it is the main function of the app.
- The instructions on the home page with a large font size and font weight are to cater to people who might not be familiar with navigating through common user interfaces.

**Figure 2: Authentication Screen**



*Source: Own*

### 4.2. Making and Meaning of the app as indicated in Figure 2:

- The instructions on the home page with a large font size and font weight are to cater to people who might not be familiar with navigating through technology.
- The OTP is generated by a third-party SMTP (Simple Mail Transfer Protocol) server.
- The Prompt for the OTP generation is the phone number input which is shown below in Figure 3.
- This screen asks the user to enter the OTP that they receive in their mailbox.

**Figure 3: Authentication Prompt**
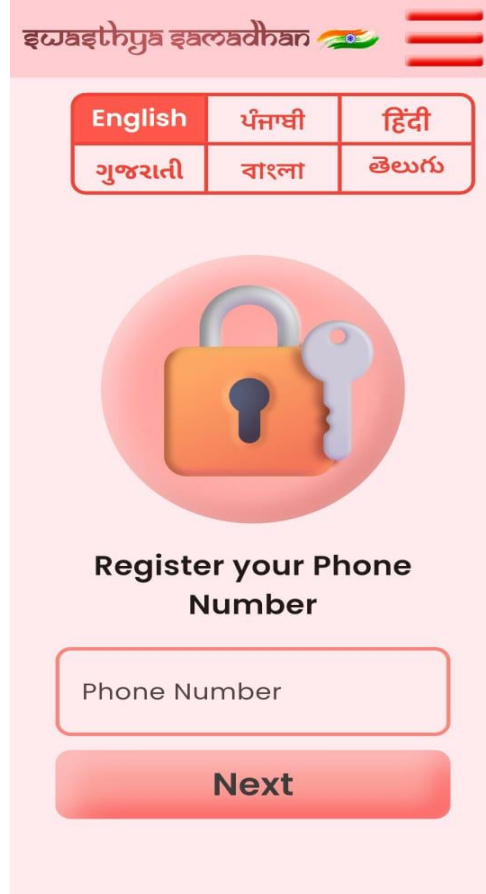


*Source: Own*

### 4.3. Making and Meaning of the App as indicated in Figure 3

- The lock and key 3D icon invokes a subconscious sense of security and conveys to the user what process the app is asking them to take part in.
- The Figure shows a "Phone Number" Input along with a button saying "Next".
- The size of the elements is large to make the app easier for people who cannot easily navigate through user interfaces.

### 4.4. Authenticity and Security

- The security and privacy of the user are guaranteed through the usage of the HTTPS Protocol which encrypts all of the data being transmitted.

- Supabase Auth is a 3rd party service that hosts its servers for authentication. The company is known for being secure and focused on maintaining user privacy.

**Figure 4: Language Choosing**



*Source Own*

## 4.5. Language Choosing Screen

- As indicated in Figure 4, the landing choosing screen is the first screen that prompts users to choose their language.
- The instruction of "Choose Your Language" is mentioned in the 6 buttons (Figure 4).
- All 6 languages are also shown in their native script and are displayed on large buttons to improve usability.

**Figure 5: Permission Screen**



*Source: Own*

### 4.6. The Screen to give permissions

- The screen to give permissions in Figure 5 prompts the users to give the app permissions to record audio and access the location of the user.
- The Icon at the top signifies the action of giving permissions and will make understanding the prompt easier.
- After pressing the button, the user will be prompted to give the app the necessary permissions. This feature is built into Android and cannot be changed or customized whatsoever.

**Figure 6: Output Screen**
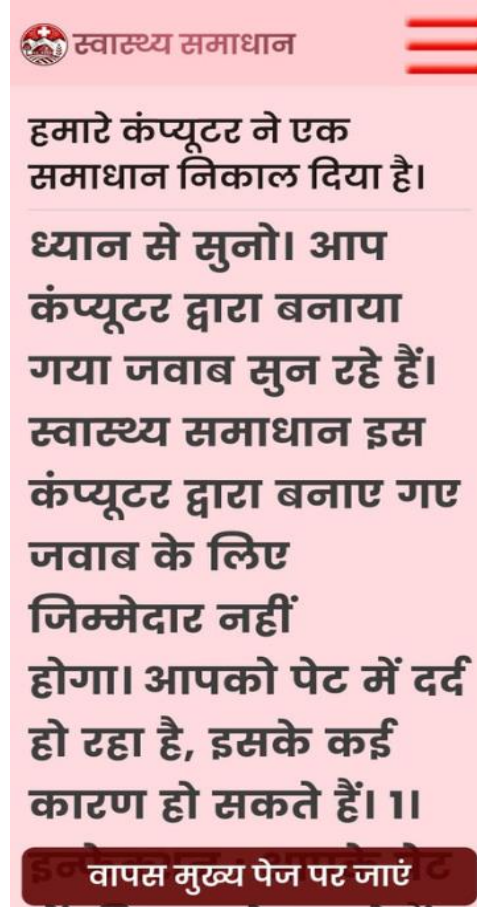


*Source: Own*

### 4.7. Output Screen

- Once the app using its embedded AI technologies processes a suitable output for the user's query, it displays the information as a standard aligned colored text.
- The app also allows the user to abort the request and go back to the home page.

## 5. Findings and Analysis

As a part of the study, 150 people were surveyed in Humaunpur in Firozabad, Uttar Pradesh; Kothaguda in Telangana; Andhra Pradesh, Sunet in Ludhiana, Punjab; Althan in Surat, Gujarat; and Khidderpore in Kolkata, West Bengal.

The Following are the maps for all of the above:
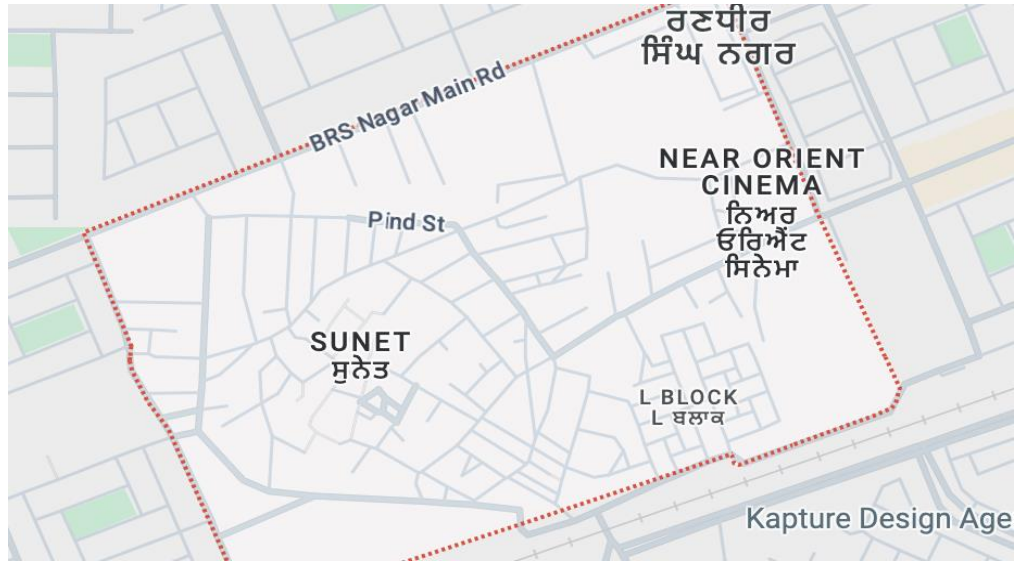
Firozabad(UP):

**Figure B: Firozabad Map**
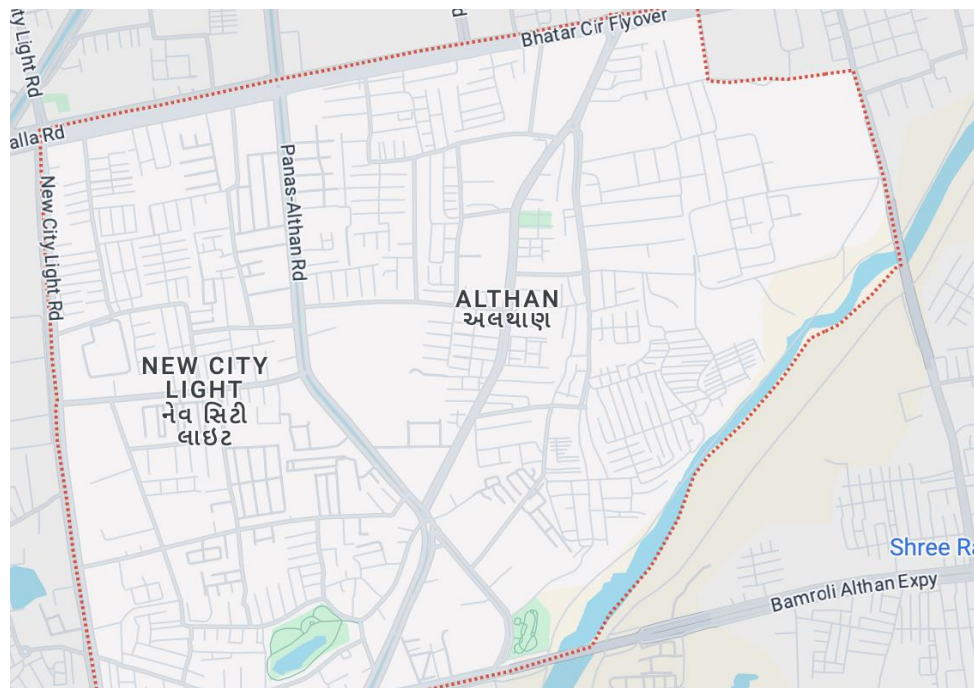


Hyderabad(Telangana):

**Figure C: Hyderabad Map**

Ludhiana(Punjab):

**Figure D: Hyderabad Map**



Surat(Gujarat):

**Figure E: Hyderabad Map**

Kolkata(West Bengal):

**Figure F: Hyderabad Map**



The median income of the people who were surveyed ranged from Rs. 10,000 to Rs 30,000 per month.

The primary reasons for the usage of this were:

- To respond to emergency services
- Online medical advice (due to time constraints and affordability)

The survey indicated that due to the income levels that were researched the respondent's communication was inadequate due to: network issues, low levels of income at times bordering abject poverty[1,] and reluctance of the respondents to voice their opinions on camera.

For those respondents who had given their consent for their opinions to be recorded, the researchers provided them with a small stipend.

The app provided a button through which all queries of the respondents were addressed by the developer. Most of the individuals who were keen to part-take the reward program reached out to the researcher. Not all the respondents who contacted the researcher lived in cities where the research team could conduct the surveys. This indicated that the advertisement that was adopted reached out to a larger segment of society other than where the researchers individually went.

The promotion of this app was done through word of mouth in the form of government programs that were part of the set instructions given to *Anganwadi* workers. The awareness of this app was enhanced via Google Play through its 'Sponsor Program' through digital ads on various Google platforms.

The median age group of the respondents ranged from 25 to 35 years old where 70% were men and the balance was women.

The app worked in helping the respondents find a solution to their ailment. If the ailment could be addressed without going to a general practitioner or a pharmacist, it was advised to the user. This advice was provided by the Artificial Intelligence that was embedded in the app. The AI provided solutions that ranged from home remedies like putting a balm (in case of a headache), to eating carom seeds (ajwain) to address stomach issues. The app worked on the provision of both preventive and curative measures to address basic ailments. It was made very clear that though there were home remedies for various ailments, addresses, contact numbers, and Google Maps links of the required doctor were also displayed simultaneously. This gave the respondent the option to follow home remedies or else visit the nearest doctor based on where they resided. The AI that was incorporated into the app could filter the ailment and advise accordingly. The AI was trained to recommend medical practitioners for the ailment that the respondent was suffering from. These doctors were within the vicinity of the address of the patients.

**Telemetry Data**

Telemetry data is the data that is collected by analytical tools automatically and compiled in a database on the "cloud".

The telemetry data when analysed showed that the users were broadly divided into 3 categories: User A, User B, and User C. These users were defined in the following manner:

**User A**

In User Group A, 93% chose either Hindi or English as their preferred language and took approximately 50 seconds to complete the signup workflow, which included choosing their language, giving permissions, and signing up with their registered mobile number. A user also checked on average the details of approximately 4.1 service cards. This kind of user also clicked 2.3 buttons on the output page and 84% of these kinds of users paused the voice narration before it completed.

**User B**

In User Group B, 80% chose neither Hindi nor English as their preferred language and took approximately 74 seconds to complete the signup workflow, which included choosing their language, giving permissions, and signing up with their registered mobile number. A user also checked on average the details of approximately 1.3 service cards. This kind of user also clicked 0.7 buttons on the output page and 12% of these kinds of users paused the voice narration before it completed.

**User C**

In User Group B, there was no trend for the choice of language, and a user took approximately 1.5 minutes to complete the signup workflow, which included choosing their language, giving permissions, and signing up with their registered mobile number. A user also checked on average the details of approximately 0.1 service cards. This kind of user also clicked 0.7 buttons on the output page and 54% of these kinds of users paused the voice narration before it completed.

The analysis indicated that User A formed 62% of the total, User B formed 34% of the total and User C formed 5% of the total. This is indicated in the Pie Chart (figure)

**Figure 7: User Group Division**
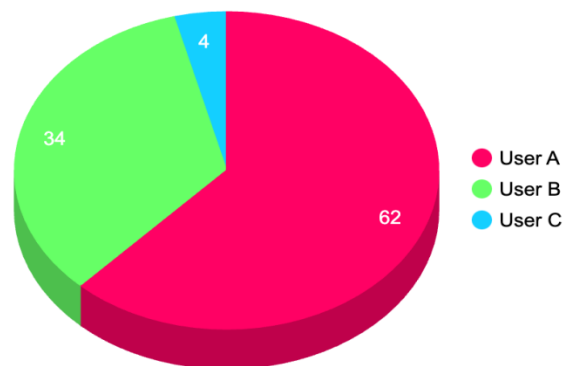


*Source: Own Source*

## 6. Disadvantages

On perusal of the app and asking the respondents about improvements, they specified the following:

1.  Users wanted a narration button that would narrate the instructions on the screen (52% of users), as most of them were illiterate and would rather hear the instructions on how to use the app than read them.

2. The users wanted an automatic connection to the app without giving out any of their details (phone numbers and emails) (34% of users). This is also known in technical parley as "Anonymous Sign In".
3. A very miniscule number of users wanted to see a dark mode of the app (2% of users).
4. 67% of the respondents wanted the AI embedded in the app should respond in a shorter period to the questions that were asked (they felt that a wait time of 50 seconds was too long).
5. Only 5% of the users indicated that the app should have more features than the ones already existing.

**7. Conclusion and Suggestions**

Based on the analysis of the app, it was found that medical facilities for the respondents were lacking. It was also observed that most of them did not know how to address their medical problems. The app was extremely useful in portraying the right information to the respondents based on their ailments and correctly suggested appropriate medical help closest to their place of residence. This would help in increasing their work-life balance as well as reducing the number of man-days lost due to illness resulting in an increase in income and a healthier life.

The app had the option of choosing one out of six Indic languages: English, Hindi, Punjabi, Bangla, Gujarati, and Telugu. It was observed that those who opted for Hindi or English seemed more privileged than the ones who chose any of the other languages and navigated the app's user interface more swiftly. 64% of the respondents chose either Hindi or English as their preferred language, and 36% of the respondents chose one of the other languages.

The respondents were observant enough to voice their suggestions for the improvement of the app. The researchers would take the suggestions seriously and work on the maintenance of the app accordingly. The problems that the researchers faced were paucity of time and money. Given both of the above, they would be in a position to increase the sample size as well as change the app to an Interactive Voice Assistant system that would respond to the voice of the user on a mobile call. Incorporating this technology would result in higher adoption and user accessibility. This would result in greater satisfaction and result-oriented solutions.

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