

AN ANDROID BASED APPLICATION FOR DIFFERENTLY ABLED PEOPLE

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ABSTRACT

Language serves as a vital means of communication, and technological advancements have greatly enhanced our ability to share thoughts and emotions. Nevertheless, a portion of the global population faces challenges due to deafness and speech impairments, making communication with the general public an ongoing struggle. Individuals with such disorders encounter significant communication barriers. Gesture-based communication has emerged as a solution for facilitating interaction between those who are hard of hearing and unable to speak. This project aims to empower these individuals by developing an Android-based application designed for the hearing-impaired and speech-impaired, acting as a communication intermediary. The system integrates with our proposed Android Awaz application, utilizing an online database to optimize memory usage, and offers both text and speech conversation interpretation, making it an efficient tool for communication. This system is meticulously developed to be user-friendly and efficient, facilitating effortless communication.

Keyword: Sign Language Recognition (SLR), Computer Vision, American Sign Language, communication, Differently-abled people

INTRODUCTION

The estimated population of Pakistan is 231.4 million recorded in 2023 [1]. According to the World Health Organization (WHO) statistics, Pakistan has at least 30 million disabled population, which is more than the population of, New Zealand, Norway, Lebanon or Kuwait [2]. Sign language is a good way of communication for differently abled as compared to natural language. Pakistan also has special schools in different areas for such populations. According to a survey, Pakistan has nine million children that have hearing disability among them 1.4 million disabled children do not attend the school [3]. Alone in Pakistan, there are 30 million people who are disabled by birth and 7.4 percent of them are dumb and deaf. As

there is no cure yet found but we can use the benefits of technology to help these people. Pakistan Association of the Deaf (PAD) is a non-benefit association that started in 1987 to help and bolster the hard of hearing network in explaining their problems [4]. The job of PAD is to engage, instruct and create administration aptitudes in the hard of hearing network and advance S.H.O (self-improvement association idea) in them. PAD give their administrations to the hard of hearing network and just get restricted government financing and backing, they depend vigorously on the liberality of the network to assist them with continuing to have any kind of effect <https://www.padeaf.org/>.

A. *Deaf Organizations and Schools in Pakistan*

In Pakistan there are many organizations for deaf people and also have different schools that provide special education to deaf/dumb people

[5]. Here are some of the organizations and schools are discussed below in table.1.

TABLE 1. DEAF AND DUMB ORGANIZATIONS IN PAKISTAN [5]

S.No	Deaf and Dumb Organizations in Pakistan	Location
1.	Deaf Reach Schools and Training Centers	Karachi (Head Office)
2.	Bahawalpur Deaf Welfare Society	Bahawalpur, Punjab, Pakistan
3.	Deaf Association (Regd.) Tehsil P.D. Khan	JhamWala, Tehsil Wazirabad, Gujranwala
4.	Dumb & Deaf Association (in Abbottabad)	District: Abbottabad
5.	Dumb & Deaf Association (in Jhelum)	Tehsil Pind Dadan Khan, Distt. Jhelum.
6.	Dumb & Deaf Association (in Kohistan)	District: Kohistan
7.	Dumb & Deaf Association (in Pak Pattan)	Ghulla Mandi Bazar, District Pak Pattan
8.	Dumb & Deaf Association (in Peshawar)	District Peshawar.
9.	Dumb & Deaf Association (in Sialkot)	Tehsi Daska, Distt. Sialkot.
10.	Deaf & Dumb Ccb (in Larkana)	Tehsil & District Larkana
11.	Deaf & Dumb Society (in Jhelum)	Railway Road, Tehsil & Distt. Jhelum
12.	Deaf & Dumb Welfare Society (in Lahore)	Takia Bhari Shah, Chowk Baba Azam, Lahore.
13.	Deaf & Dumb Welfare Society (Shiekhupura)	P.O. Sangla Hill, Tehsil & Distt. Shiekhupura
14.	Deaf & Dumb Welfare Society (in Kasur)	Railway Road, Tehsil & District Kasur

B. Nature of Disability

The National Socio-Economic Register of Pakistan (NSER) analysis estimates the value for

different kinds of disability. The table 2 shows the distribution of people with kinds of disabilities [6]

TABLE 2. NATURE OF DISABILITY WITH DISABILITY PERCENTAGES [6]

All Limbs	Hearing	Vision	Speech	Mentally Retarded	Lower Limbs	Upper	
Pakistan							
Both Sexes	5.6	15.9	8.8	18.2	40.7	10.8	100.0
Male	5.3	13.9	8.6	19.4	40.6	12.2	100.0
Female	6.0	18.6	9.1	16.5	40.9	8.9	100.0
Panjab							
Both Sexes	5.1	17.2	8.3	17.2	41.0	11.2	100.0
Male	4.8	14.7	8.0	18.2	41.4	12.9	100.0
Female	5.8	20.7	8.7	15.6	40.4	8.9	100.0
Sindh							
Both Sexes	6.0	14.1	9.9	19.2	40.3	10.5	100.0
Male	5.7	12.8	9.6	20.6	40.6	11.4	100.0
Female	6.5	15.7	10.4	17.2	39.6	9.2	100.0
Khyber Pakhtunkhwa							
Both Sexes	5.2	14.1	9.0	20.6	42.0	9.1	100.0
Male	5.2	12.8	9.0	22.3	40.2	10.4	100.0
Female	5.2	15.7	8.9	18.4	44.3	7.5	100.0

Baluchistan							
Both Sexes	7.9	16.9	7.5	16.3	37.5	13.9	100.0
Male	7.8	16.3	7.8	17.4	36.5	14.2	100.0
Female	8.1	17.6	7.2	15.1	38.6	13.5	100.0
Islamabad							
Both Sexes	5.2	11.7	9.2	23.4	40.1	10.5	100.0
Male	4.8	10.9	8.5	24.3	39.8	11.8	100.0
Female	5.9	12.9	10.2	21.9	40.6	8.5	100.0
Azad Kashmir							
Both Sexes	6.0	14.1	10.7	17.8	40.0	11.4	100.0
Male	5.9	13.2	9.9	18.5	39.7	12.9	100.0
Female	6.2	15.5	11.6	17.0	40.4	9.4	100.0
Gilgit Baluchistan							
Both Sexes	13.0	15.8	17.5	13.4	31.1	9.2	100.0
Male	13.0	14.8	16.9	14.5	30.4	10.5	100.0
Female	13.1	17.0	18.1	12.2	32.0	7.6	100.0
Federally Administrated Tribunal Area (FATA)							
Both Sexes	6.9	15.1	8.0	20.2	40.0	9.5	100.0
Male	6.4	14.0	8.1	22.0	39.1	10.4	100.0
Female	7.5	16.5	7.8	18.1	41.8	8.4	100.0

The proposed application provides a platform for communication among disabled people and normal people. The proposed application provides a platform for communication which is based on a picture communication system. The proposed application consists of different pictures that correspond to the signs of communication.

C. Objectives and contributions

The following are the main objectives of the proposed application. To facilitates the communication platform between disabled people and non-disabled people. Remove the communication barrier between normal and differently-abled people. To provide a user-friendly interface. To provide a sign language interpreter that not only gets input as text but also as speech. Help deaf and dumb to interact more with normal people. Offer a great tool for parents to teach their deaf and dumb kids. The proposed application is dynamic it means that the application automatically updates no need for manual modification because it is connected with an online database.

The application uses the translator to converts voice into text and text into a voice for ease of communication. We have developed our application in the android studio because Android Studio (AS) uses a highly integrated

Gradle build system <https://developer.android.com/>. It is a great tool that offers dependency management. It enhances the developer experience because it is more extensible.

The remaining paper is organized as follows: Section II gives a brief review of the preliminaries required to understand this work and related research on differently abled people. This is followed by Section III gives a description on development of the Android application. Section IV is about experimental results and section V is about evolution and testing and Section V summarizes this study with directions for the future research.

II. RELATED WORK

We have discussed related work and related applications for differently abled people. The Nirvatha Vadathi Android application is designed to help the deaf and dumb community communicate with others. It uses technologies like voice to text conversion and speech to text conversion to convert voice input into text output. The application is built using Android Studio and includes a frontend design made using XML connected using Java along with SQLITE as a database. Users can log in and choose from different options like sending text

messages, voice to text messages, emergency messages, sending GPS location, and a feature that assists in Indian Sign Language. [3].

The advanced glove works by detecting the movement of fingers through sensors attached to the glove. The signals from the sensors are then processed by a NodeMCU microcontroller, which generates combinations of three bits using the output of sensors. The glove is interfaced with an Android application, which converts the signals into speech and displays the message on the phone screen. [7].

The Sign Language Recognition System using TensorFlow is a machine learning model that can recognize different sign language gestures and translate them into English. It uses a webcam to capture the gestures and then processes the data using TensorFlow object detection API. The model was trained using a dataset created from the webcam. The system is designed to work in real-time and has the potential to bridge the communication gap between deaf and dumb individuals and the rest of society. [8].

The Automatic Arabic Sign Language Translator works by using image recognition techniques to identify Arabic Sign Language alphabets and translate them into text and speech. The system is based on machine learning algorithms that have undergone recent developments, making the efforts in image recognition systems very accurate. However, the proposed translator has several limitations, such as being only proposed for Arabic Sign Language alphabets and not for words, finger writing, and other gestures. Additionally, the dataset used has a limited number of images, and the process of translating oral and written words to sign language is still not integrated. [9]. The proposed system uses deep learning techniques to recognize Indian Sign Language gestures. The system utilizes a dataset of hand gesture images to train a machine learning model. The trained model is then used to recognize and translate Indian Sign Language gestures into English. The system uses various techniques such as scikit-learn, key frame-oriented clips, and DCA-based unimodal feature-level fusion of orthogonal moments to achieve high accuracy in recognizing the gestures. The system also uses OpenCV's Find contours function to extract features from the

hand gesture images. Overall, the system works by training a machine learning model to recognize Indian Sign Language gestures and then using the model to translate the gestures into English. [10]. The dumb communication translator is a gadget that translates hand motions into speech for individuals who are deaf and dumb. It likely uses sensors or detectors to capture the hand motions, which are then processed and translated into conventional language or speech output. The translator may also consider facial expressions and postures as part of the gesture recognition process. The specific technical details and algorithms used are not provided in the given texts, but the overall goal is to connect individuals who are deaf and dumb to the outside world by translating their sign language into understandable speech. [11]. The Smart Video-Based Sign Language Application is an Android application that helps deaf-mute individuals communicate with ordinary people. It offers a sign language keyboard input that translates sign words into Arabic or English and vice versa. The application also provides daily words to teach deaf and dumb children with attractive colors, pictures, cartoons, quizzes, and games. The application can be installed on a mobile phone, and the program interface that appears to the user depends on their condition. If the user is a normal person, they can communicate with people from the deaf and dumb category through the voice/text feedback feature, which reaches the deaf and dumb user in the form of animated stickers/text. If the user is from the deaf and dumb category, they can communicate with normal persons using animated stickers/text/videos, which turn into a voice/text note when sent to a normal person. [12]. The SignDe application works by capturing hand gestures through the device camera and recognizing them using the MediaPipe technology. The recognized gestures are then translated into text and audio output using an LSTM model. The application is designed to help bridge the communication gap between the deaf and mute community and the general public. [13].

Table.3 show the comparison of all the related work which we have mentioned above with the features of our application.

TABLE 3. COMPARATIVE ANALYSIS OF STATE-OF-THE ART

No	Name of application	Platform/Mode	Features	Limitation
1	Nirvatha Vadathi An Application to Assist Deaf and Dumb	Android application	Sign language keyboard for communication, Speech-to-text and text-to-speech conversion, Emergency module to send GPS location to emergency contacts, Help Center for learning Indian Sign Language, SMS option with sign language keyboard and emojis, User login with options for sending text messages, emergency messages, and sending GPS location,	Lack of in-depth usability testing, Limited to Android device, only recognizes Indian Sign Language gestures, No mention of support for other languages
2	Advanced Glove for Deaf and Dumb with Speech and Text Message on Android Cell Phone	Android application	three flex sensors, signal conditioning, NodeMCU for processing and wireless communication	the system suffers from a major drawback of non-portability, as it is developed for desktop use and requires a good resolution camera and high-fidelity microphone for faithful conversion of voice into gestures and vice versa
3	Sign Language Recognition System using TensorFlow Object Detection API	Python with OpenCV and TensorFlow object detection API.	TensorFlow features a pre-trained TensorFlow model, real-time detection and recognition of sign language gesture using a webcam,	need for strenuous labeling for isolated SLR methods, the proliferation of errors in continuous SLR methods, inaccuracies introduced by vision-based methodologies, and the lack of large datasets
4	Arabic Sign Language Translator.	Android application	Artificial intelligence and uses image recognition techniques to translate Arabic sign language, high accuracy, mobile devices, making it easily accessible to a wide range of users.	The proposed translator is limited to translating Arabic sign language alphabets and not words, finger writing, and other gesture
5	Indian Sign Language Recognition Using Deep Learning Techniques	Android application	The proposed mobile application has a keyboard translator, can photograph Indian sign language gestures, recognizes one-handed sign representations of numbers 0-9.	Lack of usability testing, Limited to Android device, No mention of support for other languages
6	Arduino Uno Based Voice Conversion System for Dumb People	Arduino Uno gadget	ability to translate hand motions into sensible speech, and the use of Arduino Uno, MP3, and speaker module.	The proposed translator is limited to translating Arabic sign language alphabets and not words, finger writing, and other gesture

7	Smart video-based sign language Application	Android application	The Smart Video-Based Sign Language Application offers features such as real-time translation, gesture recognition, and a user-friendly interface.	Use of contact sensors and image processing, limited number of letters, inability to recognize sentences and special gestures/patterns, and lack of a help message
8	Sign Detect	Android application	accurate ASL recognition and portability, converting text to sign language.	It requires hand gestures to be captured for translation.
9	Awaz Application	Android Application	Sign language alphabets including words and numbers, Speech-to-text and text-to-speech, easy to handle, online database used, automatically updated database, less memory consuming, mobile devices, making it easily accessible to a wide range of users.	Limited to Android device, there is no reference to assistance for languages other than the one specified.

III. METHODOLOGY

The proposed system provides an interface for communication between a normal person and disable person. Our system is composed of two components.

Android-based Mobile Application Named AWAZ and Online database which is connected to a dynamic website American Sign language. The whole system as stated above is a combination of two major components that is a mobile application and its related database. We have designed and established both the parts of the system and provided integration between them.

I. Proposed System Architecture

Android studio used for proposed application as Integrated Development Environment. We design and developed an Android Application using java language because Java is simpler, the syntax is much more readable than C, C++ or any other language. The proposed application has been designed very simple so that users can interact easily. One critical aspect of any methods is understanding the significance of this work in society [14]. The Database is connected with the application instead of embedded database which uses more memory utilization. It converts the normal text into sign language using the pictures corresponds to given text. It contains sign language in pictures concerning words. It also contains information about sign

language, symbols and any other specific help needed by the user. We have used an international website American Sign language URL <http://www.lifeprint.com/asl101/> for getting all the images of Sign language which is needed by our application. The Proposed application is connected with above mentioned URL link online database.

II. Working of the Proposed Android Based Application

The mobile application consists of a text field where the user input word that retrieves the corresponding picture from the database, a number button that shows a number with a sign. It consists of many features as follow. Alphabet buttons, that show Alphabets with a sign and frequently used button show the frequently used words. It also takes input as a voice using a microphone and converts the voice into the corresponding picture that retrieves from the database. Mobile Interface, Mobile has a smaller screen that’s why mobile applications have different design requirements, its user interfaces as compared to the laptop and computer systems are designed differently. Designing an interface for any software play an important role. Through interface user interacts with software or system. The interface that we designed for the proposed application is user-friendly. Text Recognition, the mobile application consists of a text field where the user input word that retrieves the

corresponding picture from the database, a number button that shows a number with a sign. Speech Recognition, it also takes input as a voice using a microphone button and then converts into text to retrieve the corresponding sign language picture from online database. Tools In order to build this application, several key tools have been considered: lightweight framework, intuitive user interface, cross-platform compatibility for mobile phones, and a strong emphasis on user friendliness. Java Language, Java is an official language for Android development and is supported by Android Studio. Java programming language is used for the advancement of android applications. In the android studio, the compilation of code tools of android SDK is required. Several other files are associated with that of java file one of them is an XML file which basically shows the layout for mobile being stored in one package. A protected set up is formed in which application is restricted not to access such parts of the system of which permission is not granted to it. The manifest file is responsible for the permission granted. In the android studio, every component performs a

different task and each task can be accomplished separately.

JSON Tool, the application is interconnected with an online database. Whenever a user enters the input in text or voice form it processes and retrieves the corresponding picture from the database through the JSON java tool.

Fig.1 show the system details that the user input the word as a text or voice that message is sent to the database of the sign language which convert the text or voice into the corresponding pictures. Each sign should be associated with the corresponding word or phrase in text form for a given word or phrase from the user's input, the system retrieves the corresponding sign language image from the database. The retrieved sign language image is then presented to the user. The proposed application offers a user-friendly interface, efficient memory utilization, voice recognition capabilities, and profound usefulness in breaking down communication barriers. Its automatic updates, making it a truly low maintenance solution, further strengthen its potential as a valuable tool for individuals with hearing or speech impairments and the broader community.

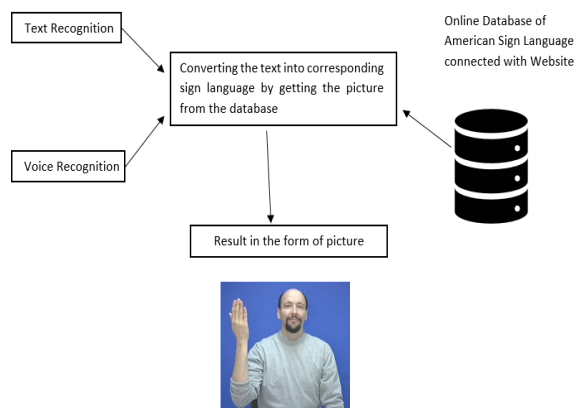


Fig. 1. Proposed app Design

IV. EXPERIMENTAL RESULT

The purpose of conducting this survey is to test the application and collect their feedbacks regarding the proposed application. The survey consists of 100 disabled persons. Table.4 shows the trail result of the survey.

TABLE 4. RESULTS

Aspect	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
GUI	70	28	0	2	0

Ease of use	73	25	0	2	0
Useful/Quality of information	55	44	0	1	0
Speech into sign language conversion	80	20	0	0	0
Translating speech into text	95	5	0	0	0

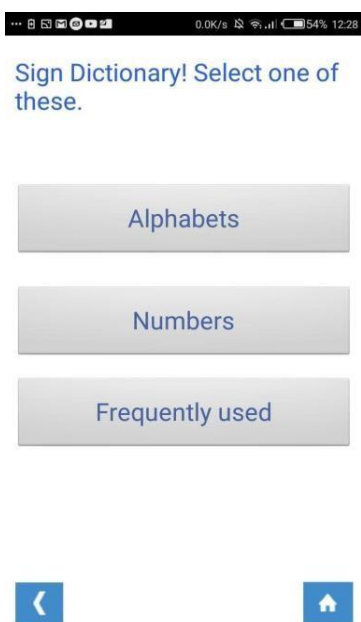


Fig. (2a)



Fig. (2b)

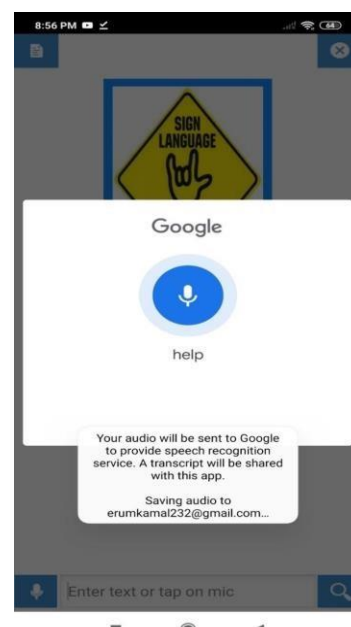


Fig.

(2c)
 With the navigation drawer, one can navigate to many screens or functionalities of the application by clicking on the icon. The proposed application has different sign language dictionaries in Alphabets, Numbers, frequently used as shown in figure (2a). Alphabet dictionary show alphabets with pictures that are used for communication as shown in figure (2b). Voice recognition defines as it is the ability of a machine to receive and interpret dictation or to

understand and carry outspoken commands. The proposed application uses Voice recognition to receive spoken comments. So, using this application a normal person gives input using voice recognition so he can get the desired sign language picture as shown in figure (2c). Figure.3 show the interface of the proposed application that the user input the query “help me” it shows the corresponding pictures/sign of the language that the differently abled people can easily understand



Fig. 3. Interface of proposed application

V. EVOLUTION AND TESTING

Evolution and testing are important components of research papers, especially in scientific and academic writing. These elements help establish the validity, reliability, and robustness of your research. The table.5 shows the comparison of features with current of the art the other application.

TABLE 5. Evaluation

S.no	Title	English Language	Embedded database	Online database	Input as text and speech	Numbers/ alphabet	Efficient Memory utilization	Automatic updates	Conversion of Phrases and Sentences to Sign Language
1	Nirvatha Vadathi An Application to Assist Deaf and Dumb [1]	X	✓	X	✓	X	X	X	X
2	Advanced Glove for Deaf and Dumb with Speech and Text Message on Android Cell Phone [2]	✓	✓	X	X	X	X	X	✓
3	Sign Language Recognition System using TensorFlow Object Detect API [3]	✓	✓	X	X	X	X	X	X
4	Arabic Sign Language Translator. [4]	X	✓	X	✓	X	X	X	X

5	Indian Sign Language Recognition Using Deep Learning Techniques [5]	X	✓	X	X	✓	X	X	X
6	Arduino Uno Based Voice Conversion System for Dumb People [6]	X	✓	X	X	X	X	X	X
7	Smart video-based sign language application [7]	X	✓	X	✓	X	X	X	X
8	Sign Detect [8]	✓	X	X	✓	X	X	X	X

The testing phase for software development is performed to ensure that software is properly working according to the user requirement. In the testing phase, each module is passed through unit testing and then integration testing is performed. Figure 2 shows the interface of proposed application that how it takes input and displays output.

A. Integration Testing

Integration testing is a systemic technique for

constructing the program structure while at the same time conducting the test to uncover errors associated with an interface. Integration testing is performed to ensure that all interfaces are work correctly. The objective is to take a unit tested component and built a program structure. As shown in figure 5.8 a phrase “Sit on the chair” has been tested step by step to perform integration testing as show in figure. 4



Fig. .4. Integration Testing

B. Validation Testing

After integration testing validation testing is

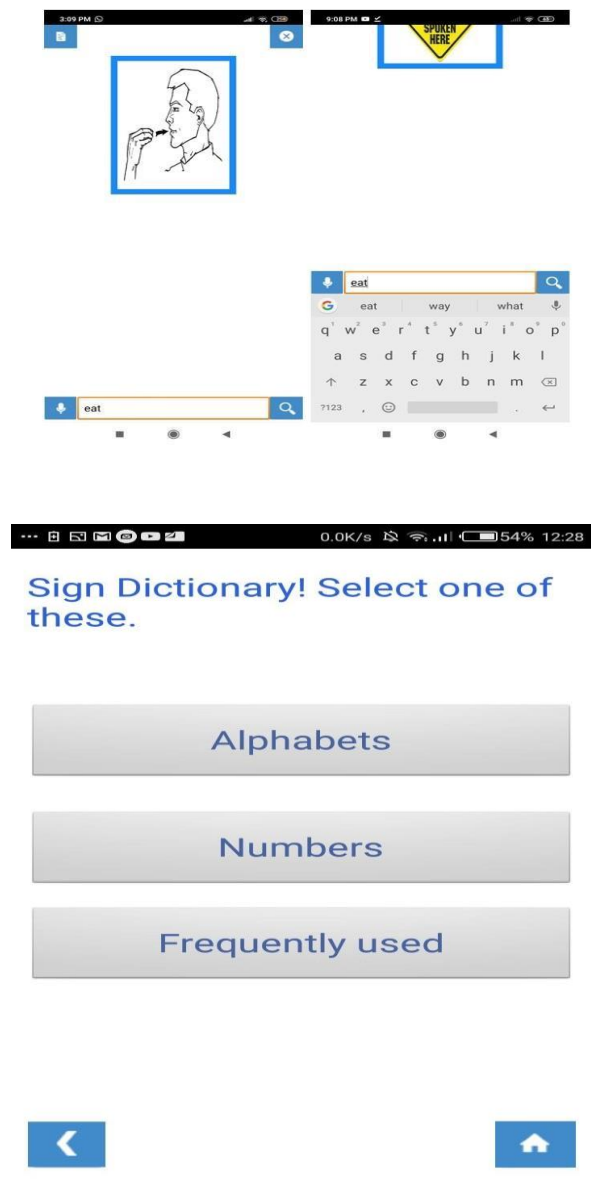


Fig. 6. Verification Testing

D. Alpha Testing

Alpha testing is performed after verification testing. Alpha testing is the user testing of a complete information system using simulated data. The proposed Application has been tested by a few people; they used and checked our application by entering different combinations of data. Textbox and Voice recognition has been checked and tested by them.

performed to ensure that the problem is solved according to the user requirement.

Fig. 5. Validation Testing

C. Verification Testing

verification testing is conducted to confirm the precise resolution of issues and to verify that the proposed application functions correctly in alignment with its intended purpose.

VI. CONCLUSION AND FUTURE WORK

The purpose of this application is to remove the communication barrier between normal people and differently abled people. Our application is not only easy to use but also very light on android phones. We have used an online database so our application uses less memory/storage of your phones. One of the key elements in our design was to make the application simple and easy to use. Along with the speech recognition we have also included direct text-based searching. So, the user hasn't any problem regarding the user query. Although this application is good enough for English based communication, we will update it for Urdu, and roman Urdu. So, a maximum population of the country can use this. Also, to understand better we will include video clips so it can be more understandable.

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