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Sign language Interpreter

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Abstract—*This paper aims to design a suitable system that will be useful for the people with hearing disabilities. In this paper we build a user friendly chat application, which helps in the communication of the hearing impaired. The hearing impaired use a very effective method of communication that is the sign language. Sign Language is a language which uses visual gestures, facial expressions and body movements for communication by deaf. The system proposes an application that can be used to convert text to Sign language GIFS and sign language GIFS to text. The aim behind this paper is to bridge the gap between a common man and a deaf by developing a chat application.*

Keywords – sign language, Deaf, Text to sign language GIFs, Android application.

1. INTRODUCTION

According to the census conducted in 2001 there are about 21 million people in India who are suffering from one or the other disability and amongst them 12.3 million people in India suffer from partial to complete hearing loss. Deaf people are individuals who have lack of hearing capability. The deaf people are different from other individuals as these

AGE GROUP	FEMALE	MALE
Under 1 year	37	59
1-4 years	315	450
5-9 years	624	783
10-14 years	658	724
15-19 years	655	722
20-24 years	568	684
25-29 years	707	720
30-34 years	1005	1165
35-39 years	1406	1441
40-44 years	1598	1749
45-49 years	1843	2153
50-54 years	2266	2970
55-59 years	2701	3781
60-64 years	3353	5326
65-69 years	4071	6704
70-74 years	4632	6664
75-79 years	5377	6321
80-84 years	6385	5793
85+	11100	5937

Figure shows males and females with hearing impairment

people have a different mode of communication and they attend different universities for their learning and education.

Table 1.1: Census of hearing impairment in 2016

Census of 2016 showed that a total of 2.2 per cent of the population or 103,676 people had hearing related disability. The deaf people use sign language as their primary mode of communication. The exclusion of deaf community from the Society is due to lack of understanding and knowledge people have towards the sign language.

As mentioned in the website [1], there are different types of sign languages. The most common ones are American Sign Language (ASL), British Sign Language (BSL) and so on.

1. American Sign Language (ASL)Speech, reading or listening skills are not needed to learn ASL, it's a manual language and ideas can be understood easily. The language is free-flowing and natural and can be translated into spoken languages. ASL has its own idioms, syntax and grammar. ASL is signed in different countries around the world.

2. British Sign Language (BSL): BSL has many different dialects that can vary from region to region and they use a two handed alphabet. According to studies there are different types of sign languages the most common ones are American Sign Language (ASL), British Sign Language (BSL) and so on. The grammar and syntax of ASL is applied to BSL but BSL is not so closely related to ASL.

There are no universal sign languages used around the world. Like natural languages sign languages originate naturally out of certain groups of people interacting and communicating with one another. The deaf are usually considered to be people who are disabled and does not need any mobile technology. However, there are people who still use mobile and mobile applications for variety of reasons such as for communication and learning. By using appropriate technology, we can engage these community of people in the real world and thus not isolating them due to their impairments. Android applications has played a vital role in mobile technology, simplicity of android application allows all groups of users to interact with the app very effectively. So in our study we aim to develop a mobile application which proves to be of a greater importance in the lives of the disabled community. This application will help the deaf people to communicate with the rest of the people in world through sign language. The main purpose of this work is to develop a system that bridges the linguistic rift by creating an application that can convert text to sign language GIFs and vice versa. This app can also take the voice and convert into text thereby making an easy means of communication. Although there exist similar applications which is used for communication, We concentrate on specific region of people and thereby use Indian sign language GIFS for communication. Some of the hand gestures of ASL and BSL Sign languages are shown in the figure above.

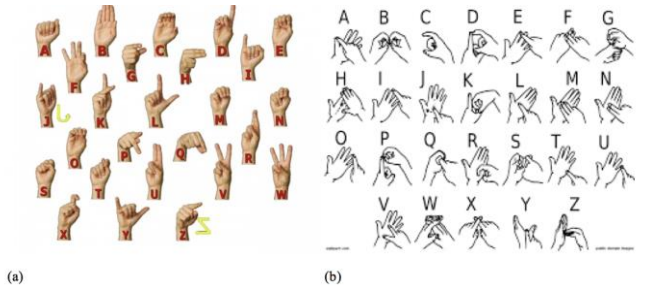

Fig 1.2 : Hand gestures of a) ASL and b) BSL language

2. RELATED WORK

In this paper the authors, Taner Arsan and Oğuz Ülgen**[2]**, have proposed a convenient system, keeping in mind people with hearing disorders and in general who use very simple and effective method; sign language. The system designed can convert sign language to voice with ease and also accommodates vice versa. Sign language conversion and a voice recognition system for voice conversion, this is undertaken by a motion capture system. The basic mechanism involved is: the sign is captured and is dictated while being written on the screen. It also captures the voice and displays the sign language meaning on the screen as motioned image or video.

The program has two parts. Firstly, speech processing is used for voice recognition. The acoustic signals are hence converted to their digital counterpart and displayed in .gif format to the user. Secondly, the motion recognition part uses image processing methods. It uses Microsoft Kinect sensor, which also gives user the voice outcome required. The project encompasses a majority of the issue as far as voice recognition is concerned.

The authors Aarthi M,et al.**[3]** proposes a sensor based system for deaf-mute people by the use of glove technology. It has a low demand of fewer components such as flex sensor, Arduino and accelerometer and hence, its cost is low compared to vision based gesture recognition system. In this system, the deaf-mute people wear the gloves (with the resistors and sensors attached to it) to perform hand gesture. It converts the gesture to related texts following which the speech is allowed to synthesize the texts by the use of text to speech synthesizer. The system consumes very low power and it is portable. The ambiguity in the gestures showed and marked great improvement in accuracy. All this was done by the sensor glove design along with the tactile sensor. The steps involved in sign language to speech conversion are described as follows:

Step1: The flex sensors are mounted on the glove and they are fitted along the length of each of the fingers.

Step2: Depending upon the bend of hand movement different signals corresponding to x-axis, y-axis and z-axis are generated.

Step3: Flex sensors outputs the data stream depending on the degree and amount of bend produced, when a sign is gestured.

Step4: The output data stream from the flex sensor, tactile sensor and the accelerometer are fed to the Arduino micro-controller, where it is processed and then converted to its corresponding digital values.

Step5: The micro-controller unit will compare these readings with the pre-defined threshold values and the corresponding gestures are recognized and the corresponding text is displayed.

Step6: The text output obtained from the sensor based system is sent to the text-to-speech synthesis module.

Step7: The TTS system converts the text output into speech and the synthesized speech is played through a speaker.

The authors of this paper M. Mohandes, et al.**[4]** review systems and methods for the automatic recognition of Arabic sign language. This paper also deals with the main challenges faced in the characterization of the Arabic sign language. In addition to that, it also throws light on the potential research direction. Two major approaches have been used in translating sign language: sensor-based and image-based techniques. This paper gives a thorough understanding on both the approaches with more detailing to the Arabic sign language. The system accesses methods for the automatic recognition of Arabic sign language. Mass deployment by the ArSLR system is also mentioned and the problems associated with it as well. The need to consider hybrid systems that combine not only multiple algorithms, but also non homogeneous sensors like cameras, sensors, LMC, Kinect, and so on that are expected to translate ArSLR in real time with the least restriction and with high accuracy, is also highlighted. The ultimate goal of systems translating between deaf and vocal people is to facilitate communication in a restriction-free environment without requiring the signer to wear cumbersome devices or colored gloves. Researchers continue to put substantial efforts into developing systems that ease these restrictions.

3. METHODOLOGIES

Planning/Defining/Designing-For the development of this project, a deep and complete knowledge about deaf people is required, which consists of how frequent they use gadgets and importance of these devices in their life, the difficulties they face with the conventional handsets etc. After gathering all these information, the UI and working models of the app is designed and defined.

App development: Android Studio provides the fastest tools for building apps on every type of Android device. The UI of the application is written in XMl and the backend code has been written in Java. To run android studio plus its EMULATOR on our system, our system needs to be inbuilt with i5(or above) processor and 8+ GB of RAM. Emulator, a

virtual mobile device provided by Android Studio, is the device which we use to install and use our app. SQL is a standard language for storing, manipulating and retrieving data in databases. We are using SQL to store, retrieve and manipulate data in our database.

Testing: Mobile application testing is a process by which application software developed for handheld mobile devices is tested for its functionality, usability and consistency. Once the app is developed, it has to be tested on various prospects, that includes the actions that has to be performed when the wrong input has been entered. We have developed ample amount of test cases which is used to test our app from all prospects.

4. PROPOSED SYSTEM

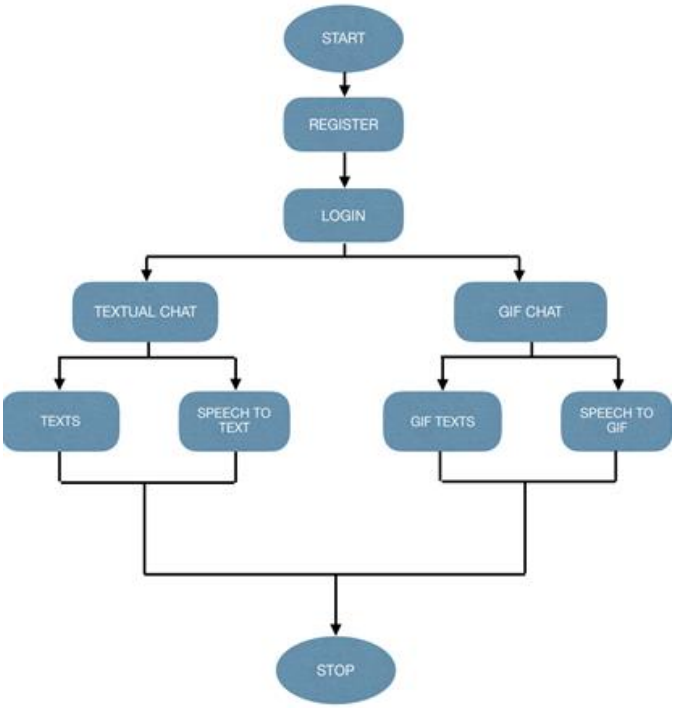

Fig - 4.1 : Abstract flowchart of the Application

The abstract flowchart depicts the working of the application by beginning with the user registration. The details to be filled by the user include name, phone number, email ID and password. Once the user has registered, the details are sent and stored in the database. The user is then prompted to login using the registered email ID and password. After login, two options are available; chat and visual GIF chat. The architecture of the application can be divided into two parts: text chat and GIF chat. During textual chat, normal messages only in the form of text are sent and received by the user. During the GIF chat, messages are converted from texts to images using a basic mapping technique. The database base contains links of the images. Each of these images have unique tags on them. When a user sends a text message, the text message is sent to the database and the tag that corresponds to the text message is mapped. The corresponding image is retrieved from the database and displayed at the receiver side. The same process is followed on the receiver side. When the receiver responds to the sender using an image, the tag on the image is checked in the database. The corresponding text is then retrieved and sent to the user and hence, conversion of image to text and text to image takes place.

Both, the text and the GIF chat are equipped with speech to text/speech to GIF functions that convert speech into text or GIF images respectively. This service allows access to the speech recognizer. The speech input will be streamed to a remote server, which converts speech to text and result will be sent back to requested application. As mentioned in the website **[5]**, the speech to text conversion is done using Recognition Listener as the interface. Android functions mainly used for this are Recognition Service that provides base Implementations, Recognition Service Callback that receives callbacks from speech recognition service and forwards them to the user, Recognizer Intent which are constants for supporting speech recognition through starting an Intent and Recognizer Results Intent which are constants for intent related to showing speech recognition. Speech Recognizer is a class that provides access to the speech recognition service. Speech to text conversion is initiated by creating a Recognizer Intent. To create a Recognizer Intent, necessary flags like action recognize speech is set which takes user's speech input and returns it to the same activity. The language model free form is another flag that takes input in English. After taking the speech input, the response is caught in onA ctivity Result (flag). It is necessary to start an Int (android. speech. Recognizer Intent) which shows mic dialog box to recognize speech input. This activity converts the speech into text and sends backs the result to our calling activity. The speech recognizer intent is initiated using start Activity For Result(function) with bundled extras. The speech functions are inbuilt functions that present in the Android Studio.

Similar process is followed during the conversion of speech to GIF images. However, the text is redirected to the image tags and the images are displayed. After the registration of the user, requests are sent to other users to join the conversation. Upon acceptance of the requests, users can communicate with the other users by images which are sign language gestures that are downloaded to the android studio. Depending on the name, the corresponding image is displayed on the app. As an example, in the GIF chat if a user sends a text saying hello, the text is sent to the database. The tag is taken and the tag is checked with each of the image tags. Whenever the text tag and image tag results in a matched query, the name of the corresponding image is sent to the calling function and the image is retrieved from the saved images on the android studio. It is mandatory to save images with the same names as the names stored on the database.

5. IMPLEMENTATION

The application consists of a single user module. The user will register and they can login using user id and password. Once they login user can chat using voice to text or send text format. User can send gif images (voice to text or only text). User can send image format. The following flowchart depicts the flow of data between the application. The test cases of the application is formulated in the table 5.1.

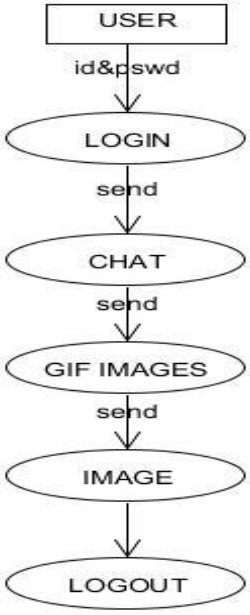

Fig 5.1 : Data Flow Diagram of the application

Test case ID	Test case name	Test case description	Test steps				Test status P/F
			Step	I/p given	Expected o/p	Actual o/p	
TC01	Login	To verify that the User has entered Valid username and password	Login with Username & pswd	Valid Usn & Pswd	Login successful	Login successful	Pass
	Login	To verify that the User has entered Valid username and password	Login with Username & pswd	Invalid Usn & Pswd	Login successful	Error Enter valid Usn & pswd	Fail
TC02	Registration	To verify that the user has registered by entering valid details	Enter all the valid user details	Valid details	Registered successfully	Registered successfully	Pass
	Registration	To verify that the user has registered by entering valid	Enter all the valid user details	In Valid details	Registered successfully	Not Registered successfully	Fail

Table 5.1: Test cases

6. APPLICATION

The application "Sign language Interpreter" could be a game changer in the field of quality of life for the Deaf and Dumb. It could help companies extend their customer service to the Deaf and Dumb (for example, Flipkart, an Indian Ecommerce Website, could cater to the requests of Deaf and Dumb people through our app). This application also helps improve the employability and the removing social stigma around the Deaf and Dumb, as it reduces the need for a translator for communication in between a person who know only sign language and doesn't. This also provides a tool for education for the Deaf and Dumb people, helping in reaching out even to remote areas which don't have special schools.

7. FUTURE WORK AND CONCLUSION

Once our present work gets completed, i.e., using only some text and mapping it to gif, we have decided that the deaf person can reply by recording a video which can be mapped into text for normal user. The other future aspect that has been planned is for people who aren't deaf by birth, and are able to read English/any other language. This aspect includes Speech Recognition in our app which will help the normal people to record their voice, and the app automatically converts this voice to text, so that even if the deaf person doesn't know sign language, he/she finds our app useful. In this paper we have discussed how can we design an Android software which acts a medium of communication between a deaf person and a normal one, or two deaf person using Android Studio as a tool to built the apart present, we have focused to basic but important conversation that takes place in day to day life. As observed in our survey, this app proves to be a handy product for deaf people, at ground level. However, despite of all the progress discussed in this paper, this system still requires further improvements, in order to get practically implemented.

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