



Balochi Speech Recognition using Android Based Smart Phone

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Abstract: The latest era of computers is called the Artificial Intelligence where multiple intelligent machines are working to ease the life of a common people. Interacting with machines via human language is one of the hot areas called Natural Language Processing (NLP). The various language speech recognition systems are already built and there is a need to build the speech recognition system for languages which are lacking in various computing resources. Balochi language is one of the Pakistani languages which lacks computing resources such as automatic speech recognition system. This paper presents the Balochi Speech Recognition system in which the Android mobile phone is controlled by speaking Balochi words. The Balochi speech recognition system calls or opens the various installed applications when the user speaks in Balochi language. For the sampling purpose a total of 230 subjects were selected to record the samples of 2300 words. These words have been recorded in various environments including silent and noisy environment. The android platform-based Balochi speech recognition system has been designed which takes input from Balochi speakers in Balochi language and performs some activities based on the proposed model. The Android application is designed to understand Balochi words. The system has been build using React Native technology. The Balochi speech recognition system has been tested for various Balochi words and produced an average accuracy of 89% and 81% for native and non-native speakers of Balochi language. The system is capable to be extended in various directions and to be applied in multiple area-based applications. Users who speak Balochi language will benefit from this Android application, which makes it easier to use smartphones using local language rather than having to speak English..

Keywords: Balochi Language, Speech Recognition, Android, React Native

I. INTRODUCTION

The human behaviors are mimicked by the machines and these intelligent machines are the result of Artificial Intelligence (AI). These human behaviors which have been mimicked are understanding, reasoning, felling, memorizing, reasoning, identifying and the most important the learning. Another replicated human behavior is the decision making or judgement is nearly accomplished artificially by the machines [1]. The understanding of human natural languages and generation of human language are two main parts of the branch of AI called Natural Language Processing (NLP). The conversion of spoken words of human language from its equivalent and similar acoustic waveform is called Automatic Speech Recognition (ASR). The speech recognition is the equal conversion of the information which is being conveyed by the human being and this conveyed information can be further used by the machines to write equivalent text or perform some activity as per orders in the form of human natural language [2]. The speech input is the same way of input as computer receives input from other devices such as mouse or keyboard [3]. The input type in speech recognition is human voice. The development of the

mobile and smartphones have opened the endless direction of the research and application of speech recognition at mobile platform. The new directions are language interpretation, dialog delivery natural spoken dialogues, keyword spotting, and various human machine interactions [4]. The commercial, successful and popular applications of speech recognition are the Siri from Apple company and the Google speech Recognition (GSR) from google incorporation [5]. These two applications are popular which enable human user to interact with computer for accessing search engines, email sending, accessing contacts and business cards, browsing of websites and some other tasks [6].

II. BALOCHI LANGUAGE

Balochi language is considered one of the oldest languages and one of the national languages of Pakistan and mostly spoken in the Baluchistan province of the Pakistan along with thousands of the speakers in Afghanistan, Iran and India. Balochi is also spelled in *Baluchi* or *Beluchi* and is one of the member o Indo-Iranian groups of Indo-European languages [7]. According to Wikipedia Balochi is spoken by 3 to 5 million speakers [8]. Typically, there are three dialects of the

Balochi language in which Eastern dialect is under the influence of Sindhi language whereas Western is influenced by the Persian. The pronunciation of Balochi language is depending upon the classification of dialect such as /ph/ ha the sound of /p/ in the west whereas the same character is pronounced as /f/ in east [9].

Table 1: Balochi dialects and speakers

Dialect	Number of speakers	Primarily spoken
Eastern Balochi influenced by Pashto and Sindhi	5 million including 1st and 2nd language speakers	Pakistan, India
Western Balochi influenced by Persian (Farsi)	1.8 million	Pakistan, Afghanistan, Iran, Tajikistan, Turkmenistan
Southern Balochi influenced by Arabic	3.4 million	Pakistan, Iran, Oman, United Arab Emirates.



Figure 1: Balochi Keyboard

III. BACKGROUND

There are various applications of Android applications including controlling home devices, home security systems, voice to text, robotics, and handicapped people help system. An android application has been created which finds the lost mobile in the local area even in the case the mobile is silent or not. The searching mechanism saves time and uses one of the two modes for its operation. The first mode is via voice input and the other is text input as messages. For finding out the mobile a user is asked to speak a unique word or send a text message containing unique word. The text matching algorithm is initiated, and the keyword is checked in the database and on the success (matching), the phone will be ringing regardless of mute state. The Advanced Encryption Standard (AES) encryption algorithm has been used. The user-friendly application finds the mobile in a given specific area and very much helpful to the people with disabilities. The home appliances have been controlled through android

mobile smartphone. The applicant has been named as automation system for home appliances [10]. The android-based phone has been used as the security system application using Bluetooth technology [11]. Another research [12] proposed an interaction between human and the robot using built-in speech recognition support of the mobile phone to control the robot using human voice. The android phone has been used for smart wheelchair which is to be used for physically challenged persons.

IV. METHODOLOGY

An android application has been created which is working on Android 5.0 and above versions. The figure 1 shows the Balochi speech recognition system which gets input in the Balochi speech (words) and then these words are sent to the mobile interface. The *koh Sulemani* accent has been used for the database and in this case the input words have been given from Balochi language which are needed to be matched with the database and then upon success the database will allow instruction for execution. The custom-built application has been prepared which gets input of the Balochi words and converts it into the trained database and upon matching or success the activity is performed, or the command is executed. In case the word does not match with the command stored in the database, the warning message of not found is generated and no activity will be generated.

A. System Parameters

The application has been created using Android studio and can be executed on Android 5.0 or above. The Balochi recognition framework works well using the sampling frequency of 16 and 24KHz. The corpus has been created by visiting various areas of Baluchistan for voice sample collection (Which can be used for another research segment). The corpus has been created for comprehensive Balochi recognition system in which the Balochi language speech recognition system will be created for various devices such as computers, mobile phones and for various software systems. This research is part of the Balochi recognition system in which 35 words have been selected for the recognition of Balochi language which controls the mobile device. The user is required to speak in Balochi words and the mobile phone running on Android platform understands those words and opens an application. For this study, a sum of twenty-five native Balochi speakers were approached and fifteen non-native Balochi speakers were asked for the voice samples which were trained by the model. The various sessions were recorded, and multiple Balochi words and double words were asked to repeat, and the samples were recorded. The voice samples were repeated to ensure the accuracy and other parameters would be achieved.

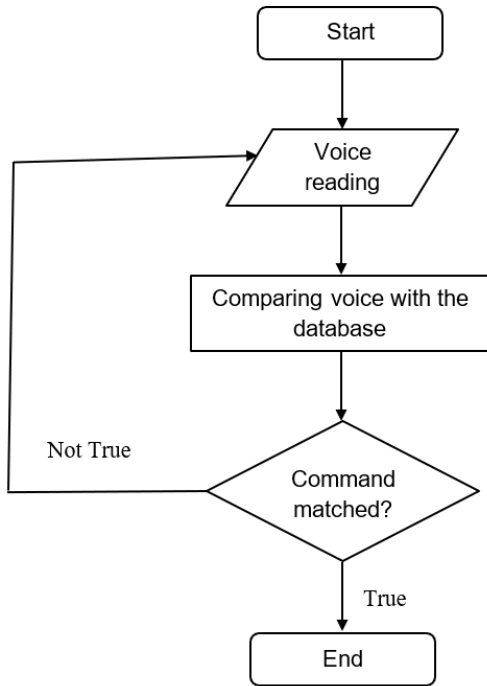


Figure 1: Balochi Speech Recognition System

V. EVALUATION

The evaluation of the system are as follows in which multiple words have been standardized for opening the various applications with Balochi words as equivalent. These words have been fixed with android applications and the subjects were asked to speak the Balochi words. Following are the words and their accuracy score for Balochi speech recognition system. The word “ڳلوڊ” has been used for “message” application. The various subjects were asked to speak the word and the application opens the message or SMS application. The SMS application or message application has the accuracy level of 80%. The word “پاس” opened the gallery application of the Android phone along with the accuracy of 85%. The other word “پاس” has been used to call or open the application of “time”. The accuracy for the time has been recorded as 79%. “موسم” word of Balochi language has been used for calling the “weather” application in Android phone with an accuracy of 78%. The best accuracy word of Balochi has been recorded as “بوج نڱ” which opens the google map application along with the accuracy of 94%. The other words used for Balochi speech recognition system has been used to call various applications were “گهڙي” for clock, “ٻڱڻس” for (tell) in English. The contacts application has been opened when subjects were asked to speak as “ناماں” . “راء دينگ ديم دينگ” Balochi word has been used for sending a message (Send). The accuracy of the non-native Balochi speakers was recognized as low as 68%

and sometimes more than 80%. The system can be finetuned by training more samples for training and testing purpose.

VI. EXECUTION

For the activation of the custom-built application, the USB debugging mode must be activated, so that the custom-built application can be executed. From the developers’ options, the debugging mode is activated. The seven-tapping activity of activating developer options is well known to every developer [14]. The process of activating debugging mode is illustrated in Figure 3. The application will ask user to allow permission to record from audio as shown in Figure 4.

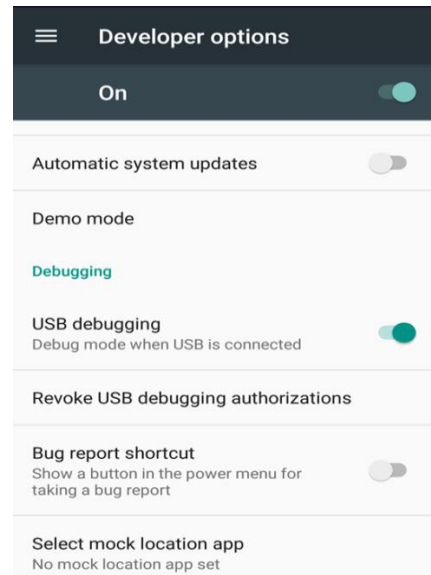


Figure 3: USB Debugging Activation

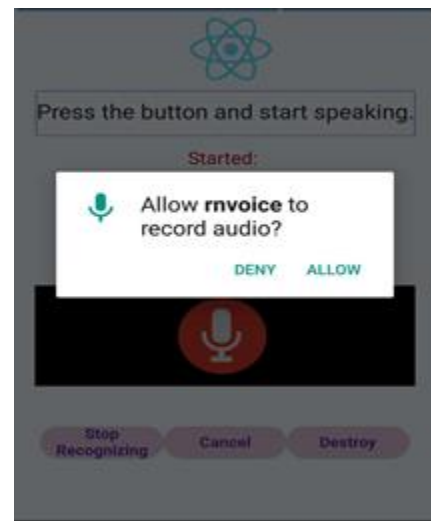


Figure 4: Getting permission by user

The application has been created in such a way that the user has least number of interactions and a single page interface of the application. The application has only one page and multiple options so that the person can easily access to the various activities. The user is asked to use mic button in red and speak by pressing the button. When user stops speaking then the recognition phase will be started and in case the user is not interested that him voice may be recognized or heard then a separate button has been given to stop the recognition process. The stop recognition button can be seen in Figure 5.

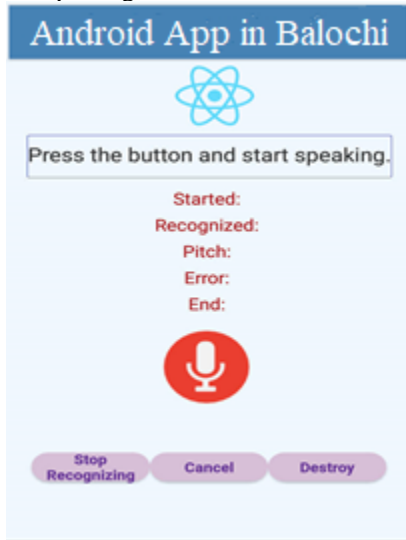


Figure 5: Balochi Speech Recognition Main View

A. Pitch and Error

One of the critical features of the human speech is the pitch which exclusively related to the speaker and it is related with the speaker. The application uses pitch feature to accurately match the voice sample. The pitch and error messages are illustrated in Figure 6.



Figure 6: Error message and the Pitch

VII. RESULTS:

Various commands have been executed and the process started by giving human word in Balochi language. The Figure 7 shows the opening of the google map application when the use asked Balochi word “بوج نگ نقشه”. The system gets the input of Balochi words and then opens the google map application on Android phone as shown in Figure 7.

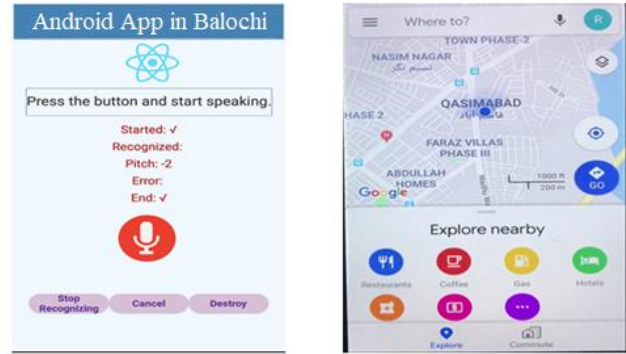


Figure 7: Result of ASR in Balochi language

The application has the solution of failure, where the user is giving some unknown words or speaks in a noisy environment or there are other people talking then the Balochi speech recognition will generate a dialog box and shows unknown command words as alert message or warning message. The process is shown in Figure 8 in Balochi speech recognition android application.

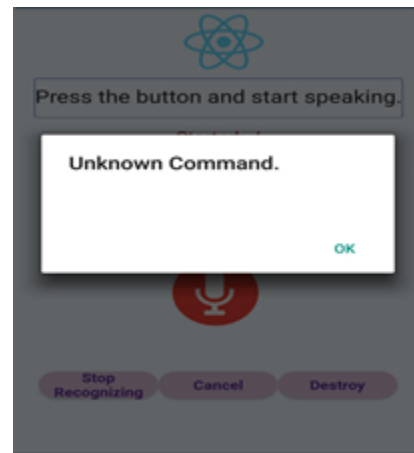


Figure 8: Alert Message

A sum of 230 subjects were selected with two hundred native speakers and thirty as non-native speakers of Balochi language. A total of 2300 words have been selected and asked subjects to speak Balochi words from native and non-native speakers. For clarity purpose a silent environment has been selected so that the accuracy of the system can be achieved. Some of the samples were taken in mild noise environment such as by turning on the fan of the room. The accuracy of

the native speakers of Balochi language have achieved 89% whereas the accuracy for the non-native speakers have been achieved nearly 81%.

VIII. CONCLUSION

Various speech recognition systems have been proposed for many of the Asian Languages, especially the national languages of Pakistan. In sense of computing Balochi language has very little research available especially speech recognition for Balochi is the need of time. Controlling android phone with Balochi speech is an idea where the Balochi people can speak with Android phone and access various applications. This paper presented the controlling of Android phone by speaking Balochi words. With the help of proposed Balochi speech recognition system, a user is not required to type a command rather the Balochi words are required to speak. The time and efforts are reduced. The execution time and other delays can be reduced and will help to people with disabilities. The accuracy of the system is at par standards and can be easily increased via more word samples. The presented study is the milestone of opening a new window of research of Balochi speech recognition and the study can be further extended to more accents of Balochi language and the system can be featured in various applications where Balochi speech recognition can be incorporated.

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