

Bilingual Learning Using Multimedia Systems Based on Sindhi and English Pronunciation

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Abstract - It is a well-known fact that the best way of learning new information is visual; using images, animations, and audio-visuals, rather than reading plain text. In this paper, a Bilingual Learning (BL) methodology has been introduced to support the non-native speakers to learn the Sindhi language with appropriate pronunciation and understand the meaning also. Multimedia based Bilingual Learning is for Sindhi and English language, cover the four basic areas of learning; Alphabet, Numbers, Sentences, Vocabulary. These areas are further classified into sub-category with each objective principle is elaborated in three ways using Translation, Transliteration, Pronunciation (Phonetic properties), which assists to build the complete Bilingual Learning platform using Multimedia for the people belonging to different regions and different languages. The intention for undertaking this research work is to develop a mobile application for individuals whose native language is not Sindhi. The mobile app will easily be compatible and usable on smartphones and conventional tablets with android operating systems. The application includes learning of Sindhi Alphabets, Numbers, Vocabulary, Phrases/Proverbs and conversation of basic sentences spoken frequently in everyday language. Through this application, the aim is to guide and teach the non-Sindhi speaker how to pronounce each letter, characters, phrases, and sentences in the Sindhi language with their meaning.

I. INTRODUCTION

With the advancement of technology, e-learning environments are becoming popular particularly in education sectors. The pronunciation-based learning approach using a mobile application system is being considered as a change agent in schools, colleges, universities, for guiding students in better understanding of spoken languages. Currently, everything is moving towards dependent on technology with advance features and innovative techniques [12]. Using Multimedia based Mobile-Learning (ML), the whole learning environment scenario is now condensed inside a small device [10]. Because of this, new a days, every students mobile/smartphones are filled with learning applications of various types. Mobile Collaborative Learning is one of the mobile application also more importance in Education such as sharing knowledge, delivering large rich multimedia contents [2]. Student use various types of devices which language skills (listening, speaking & reading) are affected, mobile devices facilitated and instructions for varying learning styles. Educational Technologies are making E-Learning as the key feature of 21st Century's education system. Fostering Self-organized Learning Environment (SOLE) and Supporting Universal Design for Learning (UDL) programs are assembled for

E-Learning. [3]

Sindhi is the official language of Sindh province of Pakistan and it is also one of the 22 constitutionally recognized languages of India. Though the proper use of Sindhi language in all of the above mentioned spheres requires its proper adaptation and progress in terms of modern computer based standards and models; however, too little work has yet been done for the standardization of Sindhi computing as well as development of computer based models of Sindhi script, speech and language [4]. The major issues in Sindhi computing as investigated and observed are due to the following reasons:

The System uses an Agile Software development methodology to develop the multimedia based bilingual learning application. Agile software development describes a set of principles for software development under which requirements and solutions grow through the mutual effort. Agile development model is also a type of Incremental model. Software is developed in incremental, rapid cycles. Learning that occurs when students build mental representations from words and pictures that are presented to them using images, animations, and audio-visuals narrations. Multimedia messages include word, graphics, symbols, logos, emojis, and animations. The principles of multimedia learning are focused on maximalisation of retention and learning rate of students.

This project is to enable a non-Sindhi speaker to learn, understand and be able to talk Sindhi Language. Through this application we aim to guide and teach the non-Sindhi speaker how to pronounce each letter, characters, phrases, and sentences in Sindhi language with their meaning. This Sindhi learning app is specifically targeted towards non-Sindhi speakers, however it can equally be used by native Sindhi speakers, children, students, teachers etc. to learn how to accurately pronounce Sindhi characters and words. The Android based application is a feature rich with its user friendly and lighted weighted frames covering almost every aspect towards learning Sindhi. It will serve as a guide for those who are novice in this field and for those who are foreign to the Sindhi belt steam yield to learn its syntax and literature[1]. This Sindhi learning app is specifically targeted towards non-Sindhi speakers, however it can equally be used by native Sindhi speakers, children, students, teachers etc. to learn how to accurately pronounce Sindhi characters and words.

It is very useful for beginners to learn speaking Sindhi. In this

application we have recorded the audio using native speaker and have tried our level best to be authentic in the pronunciation which will be easy to understand[7]. Following are the main objectives of this research Work.

To review and analyze the Sindhi words, letters, proverbs, vocabulary and conversations, their English translation, Transliteration and phonetic pronunciation.

To record accurate Sindhi phonetic pronunciation of each alphabets, words, vocabulary phrases and conversation statements.

To survey and Analyze Phonetic Pronunciations of each Letter, Word and Sentences in Sindhi.

To include Sindhi text, alphabets, numbers various data in Application.

To Phonetic Sindhi Voices.

Finally to Develop an Application on Agile Software Developmental Model

A) Scope of proposed Research

The scope of the research work includes a limited range of language characteristics. In this project, following key language components are included.

Alphabets: Alphabets are the backbone of any language to learn, Sindhi alphabets with English comparison along voice over.

Numbers: Learn Sindhi numbers and counting with transliteration.

Vocabulary: Vocabulary will contain the significant parts of Sindhi Literature, which further will be divided into other sections to familiarize the user with the daily use of words along translation and audio voice to eliminate the hurdle of quick learning.

Phrases / Proverbs: Phrase / Proverbs contain precise and short sentences of daily life along translation and audio voice to eliminate the huddle of quick learning.

Conversation: No one can master a language until be able to converse in it. The conversation part covers public conversation along introduction and small talks.

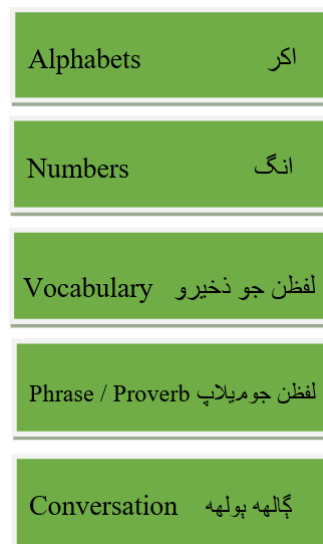


Figure 1: Key components of the System.

II. RELATED WORK

A mobile application was introduced based on the intelligent system for teaching the pronunciation of English through voice. For spoken word recognition, an speech recognition engine was used to assist the development of the teaching-learning environment system [1]. Automatic Speech Recognition (A.S.R) System was introduced for learning the French language to improve the quality of pronunciation. A mobile device was used for implementing the ASR. There was participation based on forty-two natural speakers of French students, in the ending, the ASR group declared positive results [2]. Although, a Mobile Learning (ML) environment was developed based on English comprehensive to support the Pakistani rural primary schools to understand the spoken words by students. For the experimental results, there were 45 students assigned various activities for remembering the words with their information in English recorded voice and finally, the ML declared that a helpful tool for education [3]. Another hand, the English pronunciation system was introduced for capturing the exact pronunciation. In this system, were classified into two sections, consonants and vowels and the user has an option which section wants to learn right now. This learning environment was produced by Indonesian college students. The sixty students were participated for collected the results so, finally, they announced satisfactions outcome [4]. However, a new model was implemented for English voice learning. This model was based on English grammar and exercise books, it involves 86 lessons. The exercise covers basic English for teaching learning and nouns, verbs along with tenses were used [5]. Another learning model was proposed as, human and machine communication model based on Spanish voice recognition. They obtained the results 97% accuracy by applying the lithium commands the performance is 77% better from the English speech engine model [6]. Arabic language learning

approach was introduced to learn Arabic pronunciation for teaching Arabic. This application helps the users to correct their pronunciation errors. The system specially designed for learning the recitation of the Holy Quran. The MFCC features were used for the extraction of speech signals for the implementation of the algorithm [13].

Martin Ignacio Mazola Ortega et al in [14] designed an interactive bilingual application in this paper the advantage of teaching students at universities are presented it has been developed for English and Spanish language this application is useful to make understandable the course Pulse and Digital Devices. Similarly, Patricia Martinez-Alvarez1 in [15] presented a study in which it has been examined that the perceptions of teaching science and ability to learn in bilingual contexts transfer from a one tradition to extra expensive understandings. Mediator and turning points were explored by following the cultural historical theory (CHAT). However, Faiz Muhammad et al in [16] developed a multimedia-based learning application using animation for Sindhi language where various models are described in two languages mainly Sindhi and English admin panel of this application is designed in such a way that models can be added easily. Similarly, Zeeshan Bhatti et al in [17] presented an E-learning for education of children's in this work the mobile application is developed in which digital learning of Sindhi primary

education has been covered at early stage through this application. A Sindhi textbook named "سنڌي ٻارڻو ڪتاب" (Sindhi Childs Book) {Sindhi Barano Kitab} has been covered. Moreover, Yuewen Cao et al in [18] proposed a model in which only one monolingual corpus is used to synthesize the speech in bilingual phonetic posterior gram (PPG) which is formed by a stack of one couple monolingual PPGs. Whereas, Catherine Kanellopoulou et al in [19] proposed a theory of dual-coding and multimedia learning where film subtitles are used more efficient for the digital tools by increasing the bank of vocabulary which can be helpful to be bilingual, a multimedia systems can be a best source to learn.

III. SYSTEM DESIGN AND DEVELOPMENT

The application is designed using extended version of Agile Software Development Model as shown in Figure 2. The Initial stage of the model is using requirement analysis for the bilingual learning system to teach Sindhi for Non-Sindhi speakers. The Feasibility study was done using literature review and data collection was done form Sindhi Language Authority (SLA) and other experts were used for review of data and system design. The System analysis and specification were based on Alphabets, Number, Sayings and Sentences in the bilingual Multimedia learning application. The development and implementation was done using Android

Table 1: Showing consolidated comparison of literature on Sindhi computing.

Author	Year	Title	Problem	Method/ Technique
.Hakro, et al	2015	Issues and Challenges in Sindhi OCR	Issues in Sindhi Computing	Genetic Algorithm, Java with Unicode
.Ismaili, et al	2011	Design and development of the Graphical User Interface for Sindhi Language	Unicode of GUI SL	.Programming in JAVA
.Bhatti, et al	2013	Phonetic Based Sound Ex & Shape Ex algorithm for Sindhi Spell Checker & System	Generating similar Suggestion list for misspelled word	
.Shah, et al	2004	Bi Lingual Text to Speech Synthesis System for Urdu & Sindhi	.Conversation Urdu and Sindhi	VB Programming
.Hakro, et al	2016	Isolated Optical character Recognition	Sindhi alphabet images into editable text	
.RatnaPal, et al	2015	On speech Synthesis of Sindhi Numeric	Development of text to Speech Sindhi Numeric	Java Sound API
.Batoool, et al	2015	Android Based Application for Basic Math Skill Builder	Web based System	MIT App Inventor Frame Work
.Legari, et al	2010	Towards Transliteration between Sindhi Scripts by using Roman Script	Issues in Sindhi Transliteration	
.Holla, et al	2012	Android based mobile Application .Development and its securities	Security Cehcking	
.Saad ,et al	2015	The Multimedia Based Learning System improved Cognitive System	To teach children with Intellectual disabilities	Mayor's Cognitive Theory
Cole. Jennifer	2006	The Sindhi Language		
.Chou, et al	2012	A case study of mobile Learning Pilot Project in K-12	Multiple Irrelevant Apps	

Studio with graphics done using Adobe Photoshop.

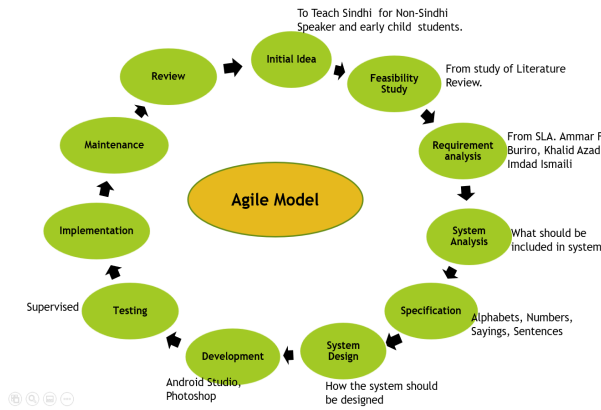


Figure 2: Agile Model approach used for this System

The bilingual learning model consists of the basic features of the Sindhi and English language. All the words are stored in database along with the pronunciation of each word.

The algorithm phases are:

1. Stored the alphabets of Sindhi and English with sounds.
2. Stored the images, representing of Sindhi alphabetical form.
3. Stored the words along with translation, transliteration, and pronunciations.
4. Stored the vegetable names into database together with images and transformation features.
5. Stored the sentences with transformation features.
6. Query for retrieves the information from the database.
7. Only the one feature at a single time is ready for executing the results.
8. If the searching query is matched like the user wants to learn the alphabet so the other features of BL will be disabled and all the alphabetical information is ready for executing the results including text, images, and sounds according to user’s selected criteria.
9. If user has typed incorrect word or not recognize by the BL environment, the systems show data not found along with Sindhi voice.

Alphabet feature covers the basic fifty-two characters of Sindhi and twenty-six characters of English. The numbers section contains all the real numbers for counting learning with the original sound of every number. The sentence category classified into sub-category as, greeting sentences like اسلام عليکم (Assalam-o-Alaikum) { Assalam-o-Alaikum }, خوش پلي ڪري آيا (Most Welcome) {Bhali Kare Aaya}, آمديد (Welcome){Khush Aamdeed}. Regular sentences are; ڇا پيا (How are You?) {Kehra Haal Aahin?}, ڇا پيا ڪيو؟ (What are you doing?) {Chha Piya Kayo?}. The sub-category of sentences is conversation, involve the various topics of the life, like discussion of personal life, educational

life, social life etc. ڇا توهان شادي شده آهيو؟ (Are you married?) {Chha Tawha Shadi Shudah Aahyo?}, توهان ميٽرڪ جو امتحان ڪڏهن پاس ڪيو؟ (When you passed your matriculation exam?) {Tawhan Metric Jo Imtehan Kadahin Pass Kayo?}.

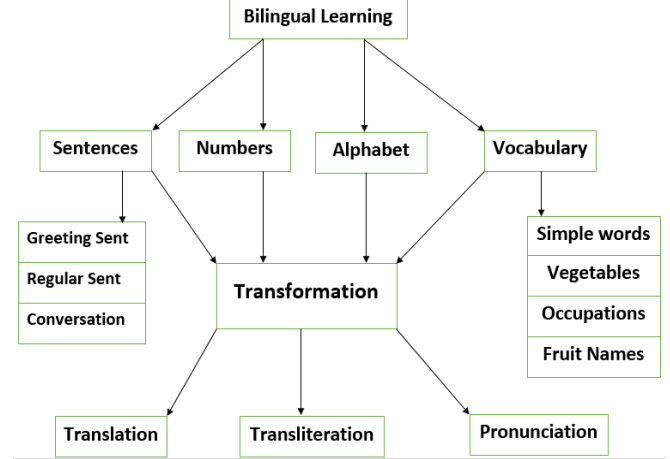


Figure 3: Bilingual Learning model based on Sindhi and English Pronunciation

The BL feature vocabulary also classified into sub-category as illustrated in the figure 3. Hence, the simple words portion covers the common words used in routine life as; پاڻي (Water) {Paani}, اسان (We){Asaan}, ڪٿي (Where){kithe}, ماڻهو (Man){Manhoo}. Vegetables contains the vocabulary as; پٽاٽو (Potato){Pattaato}, بصر (Onion){Basar}, پينڊي (Lady-finger) {Bheendi}. In the occupations, all the profession covers in this section like ڊاڪٽر (Doctor){Dactar}, ماسٽر (Teacher) {Mastar}, هاري (Farmer){Haari}. The fruit names part is consisting of the all pronunciation of fruits in Sindhi along with English meaning i.e. نارنگي (Orange){Naarangi}, صوف (Apple){Soof}, انگور (Graphes){Angoor}. All the features must have to crossover the transformation phase which split into three more kinds for producing the words as translate, transliteration, pronunciations. In the translation level, each word translated as Sindhi to Sindhi or Sindhi to English. although, the in the transliteration step the conversation of each word into roman text format. While the pronunciations level, the system produces the sound of each word or character individually.

IV. RESULTS AND DISCUSSIONS

A mobile learning methodology has presented, to involve the primary features of learning by voice-based approach with the assistance of the English to learn the Sindhi for foreigners.



Figure 4: Basic components of Bilingual Learning

The BL application is based on four components alphabets, numbers, vocabulary and sentences and indicated in the GUI of BL application illustrated in the figure 4. Each component contains some basic substantial, most relevant to the components.

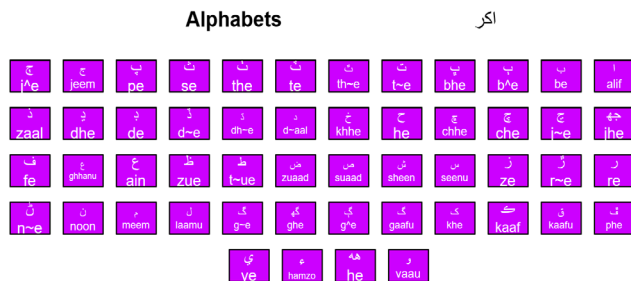


Figure 5: Key-board Designing based on BL application

A figure 5 indicates the Sindhi alphabets along with transliteration of each alphabetical character. However, the sound is produced in the Sindhi language by clicking any single character.

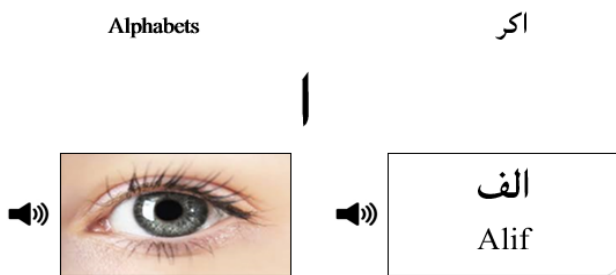


Figure 6: Sindhi alphabetical character

In figure 6: the Sindhi single alphabetical character has been displayed, the user has to click the character button, the sound

will produce and the image is also demonstrated with every single character to understand the meaning of that character.

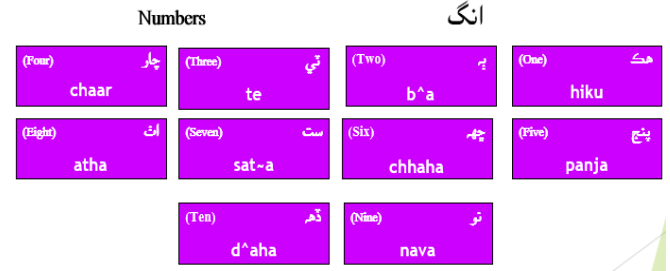


Figure 7: Numbers in BL application

There are numbers have illustrated in figure 7. The numbers from 1 to 10 have displayed in written-form with meaning in English and Sindhi along with individually transliteration of each single number. When a user clicks to anyone, that number produces its pronunciation.



Figure 8: Single number

By clicking the one from the illustration of figure 7, the figure 8 appeared and represents the single number as one with transformation properties translation in English, transliteration also the pronunciation along with image to capture the meaning of it.



Figure 9: Vocabulary as Colors

The figure 9, indicates the colors, and this is a part of the vocabulary, there are ten colors have been displayed along with written-form, origin color of that each color separately displayed together with meaning, transliteration and pronunciation.



Figure 10: Single Color

Figure 10 represents the single color obtained by clicking the item from figure 9. The only black color has been displayed along with transformation properties included in Sindhi-text format, by clicking the sound icon in the figure 8 the user can be listen to the pronunciation of selected color, while the image is also shown there for the identifying the color.

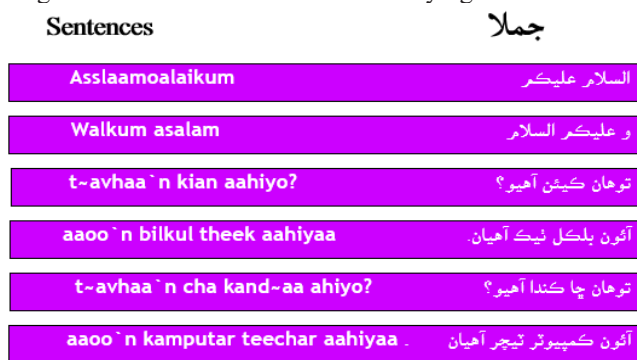


Figure 11 Sindhi Sentences

The figure 11 shows the sample of Sindhi sentences. Six sentences have been demonstrated containing the Sindhi-text-from, Sindhi transliteration. When a user clicks on it, each sentence will be appeared in the separated form. For further understanding see the figure 12.

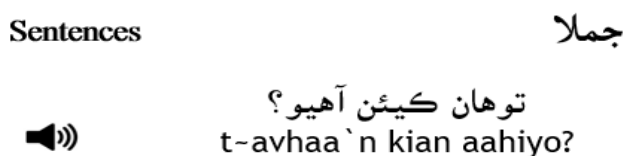


Figure 12: Single Sentence

In the figure 12, the single sentence has been displayed which obtained from the figure 11 by clicking the sentence. There is transliteration that has been displayed and Sindhi-text, when a user clicks on the sound icon, the pronunciation will be produced of that sentence in Sindhi language by the system.

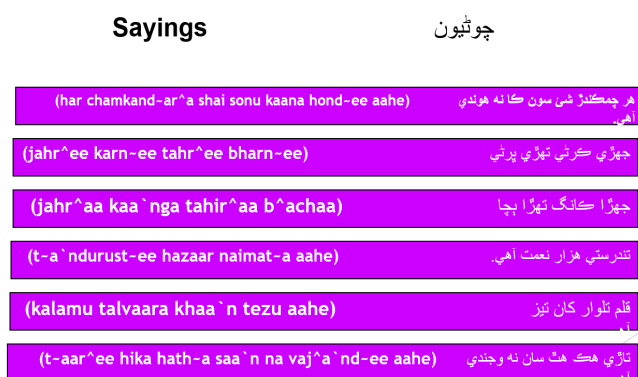


Figure 13: Saying Menu

Similar to the sentence, the Saying menu was created with multiple options for menu, and as the user selects particular saying, the next screen shown in figure 14, is where the user is able to hear, and learn about various sayings.

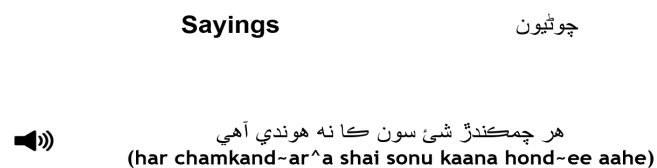


Figure 14: The Sayings output

VII. CONCLUSION

In this paper an application has introduced based on Sindhi and English learning environment, covers the basic learning features, alphabetic, numeric, vocabularies and sentences. The Bilingual learning application consists of a user-friendly environment with translation, transliteration, pronunciation along with good images for the assistance of Sindhi non-native speakers to understand the meaning of selected items. At the initial level, the application covers the basics of Sindhi counting, the alphabet covers the fifty-two Sindhi alphabetical characters. The vocabulary section covers the important words of Sindhi. However, the sentence portion covers the basics of Sindhi sentences including Sindhi greetings and conversation. Although, all the portions have been designed along with images representation and Sound of that as pronunciations of each individually. In the future, the system will cover the advance level Sindhi vocabularies and sentences.

REFERENCES

- [1] Cavus, N. (2016). Development of an intellegent mobile application for teaching English pronunciation. Procedia Computer Science, 102, 365-369.
- [2] Liakin, D., Cardoso, W., & Liakina, N. (2015). Learning L2 Pronunciation with a Mobile Speech Recognizer: French/y/. Calico Journal, 32(1), 1-25.
- [3] Laghari, Z. P., Kazi, H., & Nizamani, M. A. (2017).

- Mobile learning application development for improvement of English listening comprehension. *International Journal of Advanced Computer Science and Applications*, 8(8), 229-237.
- [4] Agusalim, I. D., Assidiqi, M. H., Kom, A., & Muhammad, A. F. (2014). Developing mobile application of interactive English pronunciation training to improve EFL students' pronunciation skill. *Journal of Education and Practice*, 5(33), 135-140.
- [5] Ally, M., Schafer, S., Cheung, B., McGreal, R., & Tin, T. (2007, October). Use of mobile learning technology to train ESL adults. In *Proceedings of the 6th Annual International Conference on Mobile Learning* (pp. 7-12).
- [6] Maskeliunas, R., Ratkevicius, K., & Rudzionis, V. (2011). Voice-based human-machine interaction modeling for automated information services. *Elektronika ir Elektrotechnika*, 110(4), 109-112.
- [7] Guilherme, M. (2007). English as a global language and education for cosmopolitan citizenship. *Language and Intercultural Communication*, 7(1), 72-90.
- [8] Shah, S. M. A., Ismaili, I. A., Bhatti, Z., & Waqas, A. (2018, March). Designing XML tag based Sindhi language corpus. In *2018 International Conference on Computing, Mathematics and Engineering Technologies (iCoMET)* (pp. 1-5). IEEE.
- [9] Bhatti, Z., & Shah, M. (2018). Sindhi Text Corpus using XML and Custom Tags. *Sukkur IBA Journal of Computing and Mathematical Sciences*, 2(2), 30-37.
- [10] Weng, T. H., & Chen, Y. J. (2015). Students' perceptions towards the use of smart phone. *International Journal of Educational Science and Research (IJESR)*, 5(3), 1-10.
- [11] Goundar, S., "What is the potential impact of using mobile devices in education", In *Proceedings of SIG GlobDev Fourth Annual Workshop*
- [12] Bhatti, Zeeshan, Imdad Ali Ismaili, Dil Nawaz Hakro, and Waseem Javid Soomro. "Phonetic-based sindhi spellchecker system using a hybrid model." *Digital Scholarship in the Humanities* 31, no. 2 (2016): 264-282.
- [13] Alkhatib, B., Kawas, M., Alnahhas, A., Bondok, R., & Kannous, R. (2017). BUILDING AN ASSISTANT MOBILE APPLICATION FOR TEACHING ARABIC PRONUNCIATION USING A NEW APPROACH FOR ARABIC SPEECH RECOGNITION. *Journal of Theoretical & Applied Information Technology*, 95(3).
- [14] Ortega, M. I. M., Wysowski, J., & Borodzhieva, A. P. A. DESIGNING AN INTERACTIVE MULTIMEDIA BILINGUAL APPLICATION FOR THE COURSE "PULSE AND DIGITAL DEVICES".
- [15] Martínez-Álvarez, P. (2019). What counts as science? Expansive learning actions for teaching and learning science with bilingual children. *Cultural Studies of Science Education*, 14(4), 799-837.
- [16] Muhammad, F., Bhatti, Z., Chand, J., Bachal, M., & Nawaz, A. (2020). Multimedia based Learning using Animation for Sindhi language. *iKSP Journal of Computer Science and Engineering*, 1(1).
- [17] Bhatti, Z., Shah, S. M., Tunio, M. Z., Brohi, S. H., & Memon, A. I. (2020). Multimedia Based e-Learning for Educating Children in Sindhi Language. *Sukkur IBA Journal of Computing and Mathematical Sciences*, 4(1), 21-27.
- [18] Cao, Y., Liu, S., Wu, X., Kang, S., Liu, P., Wu, Z., ... & Meng, H. (2020, May). Code-Switched Speech Synthesis Using Bilingual Phonetic Posteriorgram with Only Monolingual Corpora. In *ICASSP 2020-2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 7619-7623). IEEE.
- [19] Kanellopoulou, C., Kermanidis, K. L., & Giannakouloupoulos, A. (2019). The dual-coding and multimedia learning theories: Film subtitles as a vocabulary teaching tool. *Education Sciences*, 9(3), 210.
- [20] Hakro, D. N., Ismaili, I. A., Talib, A. Z., Bhatti, Z., & Mojai, G. N. (2014). Issues and challenges in Sindhi OCR. *Sindh University Research Journal-SURJ (Science Series)*, 46(2).
- [21] Ismaili, I. A., Bhatti, Z., & Shah, A. A. (2014). Design & Development of the Graphical User Interface for Sindhi Language. *arXiv preprint arXiv:1401.1486*.
- [22] Bhatti, Z., Waqas, A., Ismaili, I. A., Hakro, D. N., & Soomro, W. J. (2014). Phonetic based soundex & shapeex algorithm for sindhi spell checker system. *arXiv preprint arXiv:1405.3033*.
- [23] Shah, A. A., Ansari, A. W., & Das, L. (2004). Bi-Lingual Text to Speech Synthesis System for Urdu and Sindhi. In *National Conf. on Emerging Technologies* (pp. 20126-130).
- [24] HAKRO, D., MEMON, M., AWAN, S., BHUTTO, Z., & HAMEED, M. (2016). Isolated Optical Character Recognition. *Sindh University Research Journal-SURJ (Science Series)*, 48(4).
- [25] Saad, S., Dandashi, A., Aljaam, J. M., & Saleh, M. (2015). The multimedia-based learning system improved cognitive skills and motivation of disabled children with a very high rate. *Journal of Educational Technology & Society*, 18(2), 366.
- [26] Ratanpal, B. S., & Sahni, S. (2015). On speech synthesis of Sindhi numeric. *Indian Journal of Science and Technology*, 8(27).
- [27] Batool, Z. (2015). ANDROID-BASED APPLICATION FOR BASIC MATH SKILL BUILDER (Doctoral dissertation, INSTITUTE OF COMPUTING).
- [28] Leghari, M., & Rahman, M. U. (2010). Towards Transliteration between Sindhi Scripts by using Roman Script. In *Conference on Language and Technology*.
- [29] Chou, C. C., Block, L., & Jesness, R. (2012). A case

study of mobile learning pilot project in K-12 schools. Journal of Educational Technology Development and Exchange (JETDE), 5(2), 3.