# *Urdu Braille Editor*

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*Abstract—* Braille is a tactile writing system used by people who are visually impaired. It is traditionally written with embossed dots on paper. Braille users can read computer screens and other electronic supports using refreshable braille displays. There are two type of Braille basic and contracted Braille in different languages. Basic Braille is one to one conversion and individual cell cannot represent a word or abbreviation in this grade of Braille whereas contracted Braille cell represent a shortened form of a word. The requirement of Urdu to braille converter is increasing day by day. There are many software available for Braille but there is no support for Urdu (especially for Pakistan blind community). If there is Urdu available in that software there is an issue of punctuation and Urdu Braille contraction is not including till now. Looking forward to these issues, we think an idea and trying to develop this software "Urdu Braille Editor" that supports Grade I (basic Braille) and Grade II (contracted Braille) in Urdu. The software will be provided as a service to the blind organizations.

*Keywords—Basic Braille, Contracted Braille, Embosser Devices, Tactile Writing*

## I. INTRODUCTION

Braille [1] is a tactile reading and writing system used by means of blind and visually impaired humans who can't access print materials. two It makes use of raised dots to signify the letters of the print alphabet. It additionally includes symbols to signify punctuation, arithmetic and scientific characters, music, computer notation and overseas languages. A person who reads braille can roam independently among the community as braille increasingly is showing up everywhere. With the Convention on the Rights of Persons with Disabilities carried out in 2008, on account that then over one hundred fifty international locations have signed the ratification. The assertion has delivered the focus of folks with disabilities on an equal foundation with others worldwide. Braille is used in everyday conversation and as a literate blind or visually impaired individual [3], independence is given.

Braille has been the significant way of communication for the severely visually impaired people for more than a century. It has been modified to all the significant languages of the world and most of the minor ones. Additionally, special Braille combination have been performed to represent mathematics, scientific symbols, music, phonetics and other particular symbol systems. Braille has, thus, proved adaptable when faced with the problem of creating a new combinations out of the fixed-character set of just sixty-three characters. Many countries have reached at different Braille combinations for the same print symbol system, which sadly outcomes in approaching a dozen different Braille combinations[2].

The growth of wealth in many countries has permit considerable elaboration in the use of such alternative solution as talking books and special low-vision aids. The general elaboration of research and advanced tasks, mainly during the 1960s and early 1970s, has resulted in expanding effectiveness of Braille creation techniques and prominent insight into the Braille reading process. The latest trend towards technology has meant the visually impaired people require much more effective access to information in order to accomplish their jobs, as these increasingly demand the managing of information in some way or another. According to the World Health organization (WHO) [3], approx. 285 million, 39 million blind people and 246 million blind people having modest vision, 65 % of persons are visually impaired and 82% of all blind are 50 years and older. On the other hand, that education plays an important role in every person life and there is a major relationship between Braille literacy and academic progress, higher pay, and applicants, the rate of Braille literacy in advance countries is low [4]. Now in advance countries less than 3% of visually impaired kids are learning to read Braille in school [5]. In Pakistan the rate of visually impaired people is approx. 5 million [6].

Looking forward to these disabilities that increasing day by day, many countries developed alternative solution for resolving these issue such as scissor, stylus, slate, etc. in modern era as we are moving towards technologies many smart software is developed like Duxbury, Duxbury is a software that develop for blind disability in 1965-1970's in the U.S. Duxbury translator that translates many languages in basic and contracted Braille. Although, it converts Urdu in basic Braille but not properly convert punctuations and symbols and does not support Urdu contracted Braille [7].

Likewise, many more software's are being developed but containing same issue as above. In this research paper we are focusing on these problems and trying to give solution by developing Urdu Braille Editor (UBE). Urdu to Braille Editor (UBE) is a text editor that supports to write in Urdu fonts and then convert the Urdu text to Grade I Braille and Grade II Braille. UBE is designed for the need of Blind community, so that UBE help them to write and understand Urdu and converting the Urdu text in Braille. By this the

need of Blind community can be full filed and they are able to read Urdu easily.

Reduce human effect by this editor because it prints more than one copy of same document. Promote Urdu in our blind community. Through mobile Application sighted person learn Urdu and English braille using 7-line system Urdu basic Braille converter have many punctuation problems. Urdu contracted braille is not available until now. The advantages of this editor are very vast this editor includes three modules an editor for sighted and blind people a mobile application for learning Braille for sighted people and a website that is informative the website all the information about Braille and contain information about editor and mobile application through editor the sighted user could easily write Urdu and perform editing operation on the document created by the editor and the blind user could also be facilitated by the editor that the editor has voice support for write in the editor the blind could write Urdu with the help of this editor and then perform conversion of this written document in Grade I Braille or either in Grade II Braille. A guideline is also provided for the sighted user about Braille. The editor is a complete package combining both Urdu Editor and a Braille Editor. The mobile application is designed on the international seven-line system that is used worldwide for learning Braille. The seven-line system is break into seven lessons through which the sighted user can learn easily. The application is designed including English and Urdu Braille (can be seen in Figure 1). After learning Braille, the user can judge its learning by giving quiz which is available on the application.



Figure 1: Urdu Basic Braille (Grade I)

The remainder of the paper is structured as follows: The development of the proposed Urdu Braille Editor is given in Section III. The results of the proposed Urdu Braille Editor is presented and discussed in Section IV. Finally, Section V concludes the paper.

## II. RELATED WORK

Some researchers or developers are also made effort to develop this type of application firstly; they developed a web-based Urdu Braille Translator as per the standards proposed by using the UNESCO. Urdu Braille translator [8] translated Urdu script can be imported to PDF or immediately dispatched to embosser. Secondly, they developed a quiz application that they show a picture and in options they provide different Braille options for learning purpose. They developed the application for sighted users just like the blind users' parents.

Some more researchers are also made effort to develop that kind of application. They developed an android application. V-Braille application is a mechanism for conveying Braille touchscreen and vibration in a mainstream smartphone. The application program was developed for the Grade I Braille Android platform. The screen is break into six parts like six cells of Braille and if the dot appear on a particular cell the particular is about to vibrate and they also make a hint for the blind people that they know the orientation of the phone so the cell 2 and 5 vibrate more than the other cells in the screen. This supplication is developed for the blind students to learn Grade I Braille [9] in Blind schools.

J. P. Dubus, M. Benjelloun, V. Devlaminck, F. Wauquier and P. Altmayer [10], a group of French researchers at the Lille University of Science and Technology developed an algorithm, called Lecto-braille, which transformed Braille archives into simple text. The device photographed the Braille textual content with a low-resolution CCD camera, and used spatial filtering techniques, median filtering, erosion, and dilation to extract the Braille. The Braille characters have been then converted to natural language the use of adaptive consciousness.

J. Yin, L. Wang and J. Li [11] have described an approach for scanned Braille images, pre-process the Braille image, convert into Braille binary image and then extract the Braille facets by using the fixed nature of Braille. Then grouping, locating, marking the Braille cells, set up a popular Braille Corpus in accordance as one-to-one Correspondence between Braille mobile and personality incorporates Hanyu Pinyin, Arabic numerals and inter punctuation, then fit the identified Braille cells and subsequently output the sentences shaped Hanyu Pinyin, Arabic numerals and inter punctuation. The approach is simple convenient, and effortless to operate. The paper introduces Braille extraction, Braille recognition, illuminates unique experimental method in details. Experiments show that the method can correctly extract Braille, and accurately convert the Braille into Hanyu Pinyin.

P. Rajarapollu, S. Kodolikar, D. Laghate and A. Khavle [12] existing the implementation of Braille to textual content / speech converter on FPGA (Field Programmable Gate Array) Spartan3 kit. The real Braille language is transformed into English language in everyday domain. The input is given through Braille keypad which consists of one of a kind mixture of cells. This input goes to the FPGA Spartan3 kit. According to the combos given, FPGA converts the input into corresponding English text thru the

decoding good judgment in VHDL [VHSIC (Very High-Speed Integrated Circuit)] Hardware Description Language) language. After decoding, the corresponding alphabet is transformed to speech through algorithm. Also, it is displayed on the LCD through interfacing the LCD to the Spartan3 kit.

Duxbury Translator [13] is developed by Microsoft in which there is a conversion from text to braille and braille to text. Duxbury translator has a support of eighteen languages including Urdu but in Urdu they have only grade I Braille conversion available.

### III. DEVELOPMENT OF URDU BRAILLE EDITOR

This section describes about editor how the editor is designed and functionality of the editor compare the editor with other editor or translators that how UBE is better and efficient from others software's and describe its other two modules also that are Braille learning application for sighted people and an informative website about Braille.

#### A. Editor

The Urdu Braille Editor consists of three editors' Urdu editor, Basic Braille editor and Contracted Braille editor. Each editor has its own significant values and importance. The editor performs conversion of two languages.

*1) Urdu Editor:* Urdu Editor is an editor that is fully depend upon on Urdu and perform the basic editing functions like cut, copy, paste, select and print etc. The basic functions can be seen in Figure 2.
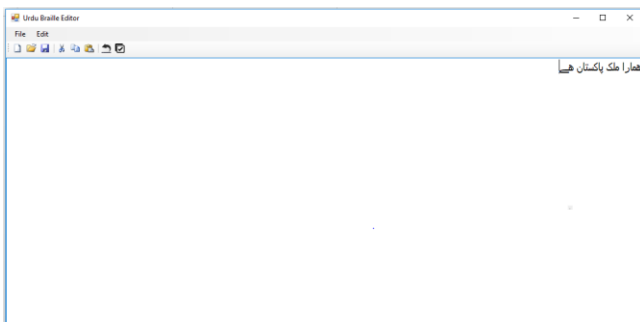


Figure 2: Urdu Braille Editor [first version]

*2) Basic Braille Editor:* Basic Braille Editor is an editor that is fully depend upon on Braille and perform the basic editing functions like cut,copy,paste,select all.print etc.the basic functions can be seen in the following figures.

*3) Contracted Braille Editor:* Contrcated Braille Editor is an editor that is fully depend upon on Braille and perform the basic editing functions like print etc.the basic functions can be seen in the folloeing figures.

#### B. Braille Learning Application

Braille learning application is the second module of Urdu Braille Editor, which can be seen in Figure 3. This app is designed for helping the sighted people who wants to learn Braille. The app is designed on the international seven-line system for English Braille. The Urdu Grade I Braille is also included in the application. It is also designed in seven lectures that a sighted could easily able to learn Urdu

Braille. The Urdu Braille was developed by Mahmood Lasi after the independence of Pakistan. After learning Braille, the user is able to judge itself by giving quiz in the application. The application contains separate quiz for both languages English or Urdu. The information about Braille, formation of English Braille and formation of Urdu Braille is also provided in the application. The following show the interfaces of the Braille Learning Application.



Figure 3: Braille Learning Application

## C. UBE Website

This is the third module of Urdu Braille Editor. UBE website is an informative which contains information about Braille, English Braille, Urdu Braille, vision losses and the products of Urdu Braille Editor. This can be seen in Figure 4.



Figure 4: UBE Website

## D. Awareness and Training Sessions

The three organizations are community in many ways and they mostly focus on the disability that factor mostly neglected by any other persons by seeing their efforts we also aim to help them not only in developing the software but also serving the community and spreading awareness about Braille. We give multiple sessions enlisted in Figure 5, on the awareness of Braille and conducted in different departments of science and pharmacy faculties of the Jinnah University for Women, Karachi

| Department | Number of Students | Class | Date | Day | Timming | Room No. |
|---|---|---|---|---|---|---|
| Computer Science & Software Engineering | 25 | BS(SE) 2nd year | 4/9/2019 | Wednesday | 09:30-10:05 | B-16 |
| Computer Science & Software Engineering | 20 | BS(CS) 3rd year | 4/9/2019 | Wednesday | 12:35-01:05 | B-17 |
| Pharmacy | 47 | 1st year | 5/9/2019 | Thursday | 09:30-10:05 | C-42 |
| Pharmacy | 68 | 4th year | 5/9/2019 | Thursday | 11:00-11:30 | C-39 |
| Food Scicence & Technology | 46 | 3rd year | 11/9/2019 | Wednesday | 10:05-10:35 | A-32 |
| Bio-Chemistry | 27 | 3rd year | 11/9/2019 | Wednesday | 11:00-11:30 | C-52 |
| Micro-Biology | 36 | 2ndyear | 11/9/2019 | Wednesday | 11:45-12:15 | C-14 |
| Chemistry | 20 | 2nd year | 11/9/2019 | Wednesday | 02:00-2:30 | C-51 |
| Bio-Technolgy | 16 | 4th year | 12/9/2019 | Thursday | 09:30-10:05 | B-36 |
| Zoology | 19 | 2nd year | 12/9/2019 | Thursday | 10:05-10:35 | C-36 |
| Botany | 9 | 2nd year | 12/9/2019 | Thursday | 12:35-01:05 | C-28 |
| Mathematics | 30 | 4th year | 12/9/2019 | Thursday | 02:00:2:30 | E-6 |

Figure 5: Training Sessions

After giving energetic sessions on Braille and achieve great responses about students we organize a two-days Braille workshop in Muhammad Uzair Auditorium (Jinnah University for Women) for the students hand on experience to write Braille using .

## E. BRAILLE WORKSHOP

- English Braille (Grade I) Workshop is conducted on 17th, September, 2019(10am-12am).
- Urdu Braille (Grade I) Workshop is conducted on 17th, September, 2019(10am-12am).
- President of Braille Resource Foundation Pakistan (BRFP) Mr. Waqar Younus attend the Urdu Braille Workshop as Chief Guest.



Figure 6: Guest of the Workshop

## IV. TESTING OF URDU BRAILLE EDITOR

There are two types of testing in UBE editor Usability testing and accessibility testing

### A. Usability Testing

Usability testing has been performed by sighted user by accomplishing the task set. The task set is given below:

**Task Set**

| | |
|---|---|
| Open the Editor | Create a new file |
| Write Urdu in the file | Save the file |
| Open the save file | If open then perform conversion |
| Close the editor | |

1) *Efficiency:* The speed in which the user is able to complete its task.

    a) Number of errors while completing a task.

    b) *Completion rate for a task*

2) *Effectiveness*: How effectively the system is able to solve the problem of the user.

    a) *Searching time:* Time to search a task.

    b) *Tasks time:* Time to complete a task

    c) *Response time: Time of response from request*

3) *Learnability:* The system is easy and understandable to its user. Time to learn and use by the user.
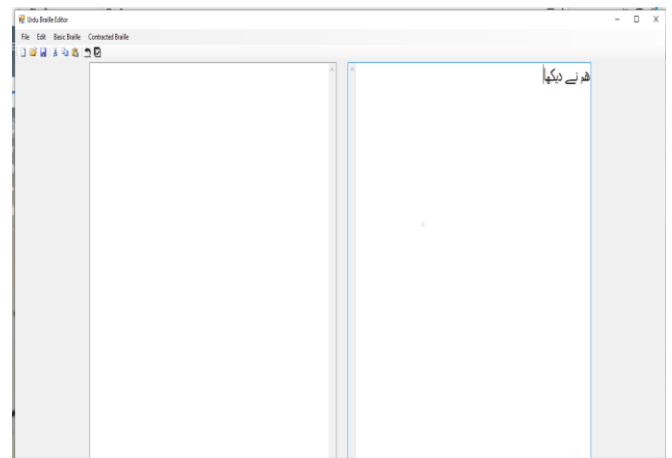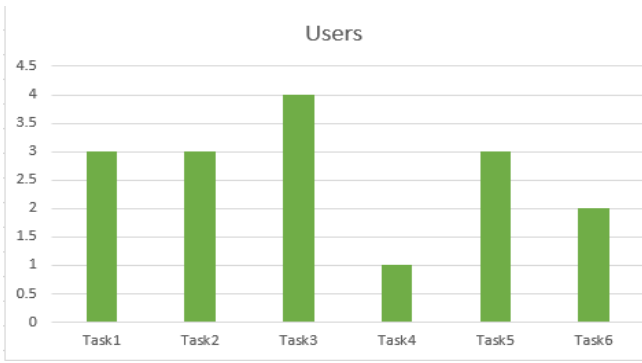


Figure 7: Urdu Typing by Sighted User

Figure 8: Graph of Task Set by Sighted User

Table 1: Sighted User Task Completed Table

| Attribute | Metrics | Task1 | Task2 | Task3 | Task4 | Task5 | Task 6 | Average |
|-----------|---------|-------|-------|-------|-------|-------|--------|---------|
| Effectiveness | Searching time (%) | 3 | 4 | 6 | 8 | 4 | 6 | 5.1 |
| | Tasks time(s) | 6 | 4 | 3 | 2 | 4 | 4 | 3.8 |
| | Response time(s) | 6 | 5 | 6 | 5 | 4 | 6 | 5.3 |
| Efficiency | Number of errors | 1 | 1 | 0 | 1 | 1 | 1 | 0.8 |
| | Completion rate (%) | 0 | 0 | 100 | 0 | 0 | 0 | 16.6 |
| Learnability | Time to learn and use(s) | 20 | 18 | 16 | 14 | 12 | 10 | 15 |

*B. Accessibility Testing*

Accessibility testing is the testing which was done by blind user and accessibility testing has been performed by using following test cases, shown in Figure 9, 10 and 11:

Test case 1: Blind and Sighted Users create Urdu file by typing in the Urdu Editor. Editor should provide all accessible functionality required for Creating, Editing and Printing Urdu file. Urdu document will print through laser printer.

Test case 2: While opening of editor it produce welcome voice and the editor voice support will be given by the editor for better accessibility of Blind users

Test case 3: Blind and Sighted Users create Braille file by converting Urdu file into Basic and Contracted Braille. Basic Braille also creates by typing in the Braille Editor. Editor should provide all accessible functionality required for creating, editing and printing Basic Braille file. Basic and Contracted Braille document will print through embosser printer.

| Project/System/Component: Urdu Braille Editor | Created By: Iqra Akram, Iqra Khan, Zunairah Khan |
|---|---|
| Test Case ID: 1 | Creation Date: 15 July, 2019 |
| **Feature/Function/Requirement to Test:** Urdu Editor | |
| **Direction – Finding:** Blind Users create Urdu file by typing in the Urdu Editor. Editor should provide all accessible functionality required for Creating, Editing and Printing Urdu file. Urdu document will print through laser printer. | |
| **Data or Activities Required to Test** | **Expected Results** |
| Open application | |
| Welcome voice is produce by editor to aware Blind for editor opening. | Sighted users directly print Urdu file. |
| Urdu Editor display to access. | Blind user convert Urdu file into Basic or Contracted Braille. |
| After creating Urdu document it saved and after opening is editable. | |

Figure 9: Test Case 1

| Project/System/Component: Urdu Braille Editor | Created By: Iqra Akram, Iqra Khan, Zunairah Khan |
|---|---|
| Test Case ID: 2 | Creation Date: 25 September, 2019 |
| **Feature/Function/Requirement to Test:** Voice support | |
| **Direction – Finding:** while opening of editor it produce welcome voice and the editor voice support will be given by the editor for better accessibility of Blind users. | |
| **Data or Activities Required to Test** | **Expected Results** |
| Open application | |
| Welcome voice is produce by editor to aware Blind for editor opening. | Blind users can type accurately after voice support. |
| All the menu function contain voice support. | All the menu features are recognizable for blind users. |
| Both interfaces (Urdu and Braille) have voice support on hover over it. | |

Figure 10: Test Case 2

| Project/System/Component: Urdu Braille Editor | Created By: Iqra Akram, Iqra Khan, Zunairah Khan |
|---|---|
| Test Case ID: 3 | Creation Date: 25 October, 2019 |
| **Feature/Function/Requirement to Test:** Braille Editor | |
| **Direction – Finding:** Blind Users create Braille file by converting Urdu file into Basic and Contracted Braille. Basic Braille also create by typing in the Braille Editor. Editor should provide all accessible functionality required for Creating, Editing and Printing Basic Braille file. Basic and Contracted Braille document will print through embosser printer. | |
| **Data or Activities Required to Test** | **Expected Results** |
| Open application | |
| Welcome voice is produce by editor to aware Blind for editor opening. | Sighted users directly print Urdu file. |
| Braille Editor display to access. | Blind user convert Urdu file into Basic or Contracted Braille. |
| After creating basic Braille document it saved and after opening is editable. | Print Basic and contracted Braille file once created. |

Figure 11: Test Case 3

## V. CONCULUSION AND FUTURE WORK

The UBE launching ceremony is held at Muhammad Uzair Auditorium (Jinnah University for Women) and the details about the event is given below.

- UBE version 1.1 is delivered to Blind Resource Foundation Pakistan (BRFP), Pakistan Disabled Foundation (PDF), and Pakistan Association for Blind (PAB).
- Event: Humanitarian Project deployment
- Date: Thursday, October 24th, 2019

In this paper, we discuss about editor and its module, The UBE editor is a combination of two languages Urdu and Braille. The screen writes Urdu and the conversion

performed to Braille. The editor performed basic functions. The second module is Braille Learning Application which also contains Urdu and English and their respective Braille formation. Voice is also provided to understand the letters and quiz is also designed for individual users to test themselves the third and last module of UBE is website which is an informative website which contains information about braille and UBE products.

The future of Urdu Braille Editor is very vast because this editor could be enhanced to provincial languages of Pakistan and the conversion could also be performed from Braille to Text many other features are also included in the editor. The Braille application could also be enhanced and may include Contracted Braille, enhance the quiz, etc.

## References

[1] Kauffman, Thomas, Hugo Théoret, and Alvaro Pascual-Leone, "Braille character discrimination in blindfolded human subjects", Neuroreport, 13.5 (2002): P.P. 571-574.

[2] Archambault, Dominique, Bernhard St¨oger, Donal Fitzpatrick, and Klaus Miesenberger, "Access to scientific content by visually impaired people", *Upgrade* 8.2 (2007): 14.

[3] World Health Organization, "Fact Sheet: Visual impairment and blindness", October 2013, WHO website, http://www.who.int/mediacentre/factsheets/ fs282/en/, Last viewed on Saturday, October 24, 2020.

[4] Johnson L., "The Braille Literacy Crisis for Children", Journal of Visual Impairment and Blindness, Vol. 90, No. 3, P.P. 276-78, ISSN: 0145-482X, May-June 1996.

[5] Spungin S. J., "Braille and Beyond: Braille literacy in a Larger Context", Journal of Visual Impairment and Blindness, Vol. 90, No. 3, P.P. 271-74, ISSN: 0145-482X, May-June 1996

[6] Haider, Sajjad, Arif Hussain, and Hans Limburg, "Cataract Blindness in Chakwal District, Pakistan: results of a survey", *Ophthalmic Epidemiology* 10.4 (2003): P.P. 249-258.

[7] Stanley, Paul B., and Arthur I. Karshmer, "Translating mathml into nemeth Braille code", *International Conference on Computers for Handicapped Persons*. Springer, Berlin, Heidelberg, 2006.

[8] Iqbal, Muhammad Zahid, Suleman Shahid, and Mustafa Naseem, "Interactive Urdu Braille Learning System for Parents of Visually Impaired Students", *Proceedings of the 19th International ACM SIGACCESS Conference on Computers and Accessibility,* ACM, 2017.

[9] Jayant, Chandrika, Christine Acuario, William A. Johnson, Janet Hollier, and Richard E. Ladner, "V-Braille: Haptic Braille perception using a touch-screen and vibration on mobile phones", *ASSETS*, Vol. 10, 2010.

[10] J.P. Dubus, M. Benjelloun, V. Devlaminck, F. Wauquier, and P. Altmayer, "Image processing techniques to perform an autonomous system to translate relief Braille into black-ink, called: Lectobraille", Proceedings of the Annual International Conference of the IEEE (Engineering in Medicine and Biology Society) Vol. 4, November 1988, P.P. 1584–1585.

[11] J. Yin, L. Wang and J. Li, "The Research on Paper-mediated Braille Automatic Recognition Method", IEEE- Xplore Digital Library, August 2010, P.P. 619-624.

[12] P. Rajarapollu, S. Kodolikar, D. Laghate and A. Khavle, "FPGA based Braille to text and Speech for blind persons", International Journal of Scientific and Engineering Research, Vol. 4, Issue 4, April-2013, P.P. 348-353.

[13] King, Alasdair, Gareth Evans, and Paul Blenkhorn. "A platform-independent Braille translator", Corpus ID: 10132165, Semantic Scholar, 2005