LETTER AND WORD PREDICTION FOR VIRTUAL BRAILLE KEYBOARD

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Research area
- Assistive Technology, Human-Computer Interaction, Game Accessibility, Mobile Devices

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Research Areas

- Text Entry Methods
- Game Accessibility
Agenda

- Background
- The project
- Prediction for Braille Keyboards
- Proposed Method
- Evaluation
- Conclusions
Background

- Typing on a touchscreen
- Six, three, two or a single finger?
- Methods with taps and swipes
- Various active areas on a screen surface
- Word prediction
The Project

Objective

- Application of prediction to a virtual Braille keyboard

Assumption

- The use of touchscreen with a single indicator

Method

- Taps, simple swipes, voice feedback

Expected results

- Improvement of a Braille keyboard efficiency
Proposed Method

- Interaction template of the *BrailleEnter* method

- Gestures:
  - *Single tap* – adding an empty dot
  - *Long press* – adding a raised dot
  - *Swipe left/right* – reading aloud next suggestion from the list
  - *Swipe down* – acceptance of suggested letter or word
  - *Swipe up* – clearing entered letter or word
Investigate a way to ’M’ – first dot
Investigate a way to 'M' – second and third dot
Investigate a way to ‘M’ – last dots
Evaluation - Procedure

- First estimation uses an average time for a single tap, long press, swipe, double tap, letter speech, word speech.
- Second estimation uses average typing time for each letter multiplying by its frequency.
- Selection of the typed text.
- Measurement of the real test using a smartphone application.
Results

- Letter prediction after 2nd dot is the best when the estimation uses average gesture time for letters.
- Word prediction after the 1st dot and 4th letter wins when estimation uses letter frequencies and when the real test is measured.

<table>
<thead>
<tr>
<th>Gesture</th>
<th>1^{st} dot</th>
<th>2^{nd} dot</th>
<th>3^{nd} dot</th>
<th>words</th>
<th>BrailleEnter</th>
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</thead>
<tbody>
<tr>
<td>tap</td>
<td>0.06</td>
<td>2.50</td>
<td>3.95</td>
<td>0.52</td>
<td>10.09</td>
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<tr>
<td>press</td>
<td>22.36</td>
<td>35.47</td>
<td>51.66</td>
<td>20.82</td>
<td>87.12</td>
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<tr>
<td>double tap</td>
<td>1.72</td>
<td>1.72</td>
<td>1.72</td>
<td>1.72</td>
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<tr>
<td>swipe</td>
<td>23.48</td>
<td>13.00</td>
<td>9.92</td>
<td>21.20</td>
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<tr>
<td>letters</td>
<td>52.27</td>
<td>31.69</td>
<td>24.19</td>
<td>50.87</td>
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<tr>
<td>words</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>total</td>
<td>105.46</td>
<td>84.37</td>
<td>91.43</td>
<td>96.76</td>
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<td>2nd estimation</td>
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<td>142.21</td>
<td>165.72</td>
<td>112.05</td>
<td>162.80</td>
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<td>measurement</td>
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<td>246.25</td>
<td>255.02</td>
<td>205.17</td>
<td>284.90</td>
</tr>
</tbody>
</table>
Conclusion

- Obtained the best result (2.46 WPM) is better than the reference value (1.77 WPM)
- Not all of Braille keyboards can be improved by prediction
- Typing speed for some letters could be increased by 1 to over 3 seconds using a letter prediction
- English words are generally short - in the case of used pangram only three words were long enough to apply a word prediction
- Word prediction saved only 9 seconds – it is about 4% of the time used by the attempt with the letter prediction after 1st dot
Future Work

- Letter prediction can be improved, taking into account the frequency of letters in English
- Word prediction can be improved by more advanced algorithm
- Experiments with a speed of voice feedback
- More experienced users will obtain better results for Braille keyboard with prediction
Thank you for attention