Efficient Keyboard for Android devices

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Abstract

The demo will present Android keyboards for Urdu and Punjabi. The major innovation of these keyboards are: (a) It has shift-less layout as all the letters are placed on the 5 rows of the keyboard layout. (b) All phonetically similar letters are placed near to each other (and their QWERTY position). (c) The word completion and next word prediction are based on efficient storage and retrieval of unigrams and bigrams extracted from large corpora. The keyboards are present on Google Play and have more than 500K downloads and 4.1/5 rating on the basis 2,275 reviews for Urdu and more than 5K downloads for Punjabi.

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Keywords: Android Keyboard, Phonetic Keyboard, Urdu, Punjabi

1. Introduction & Background

Keyboard design is a challenging task that depends upon ergonomics, set of letters, patterns of letter usage, user acceptability and user adaptability. There are many virtual keyboards available for Urdu and other Pakistani languages. In this article, we present different types of virtual keyboards and their design principles. Then we mention major keyboards of Pakistani languages. In section 2, we point out their limitations and then we present our set of keyboards in section 3. Currently, we have developed keyboards of Urdu and Punjabi. However, the keyboards of other Pakistani languages can be designed in a similar manner. In description, we focus more on Urdu keyboard, however all of the discussion can be extended to the Punjabi keyboard too.

1.1. QWERTY Keyboard

Fo English, the most commonly used keyboard is called QWERTY keyboard. It is the same keyboard layout that is present in laptop and desktop keyboards. The name qwerty is assigned due to the sequence of first five keys in the first row of the keyboard. Most of the western languages use the same keyboard or its variants. Qwerty layout influenced many phonetic keyboards too, however it is not the best in terms of usability and typing speed.

1.2. Frequency based Layouts

Frequency based keyboard layouts are introduced to increase the speed of typing. The most frequent letters of the language are placed on the home (middle) row of the keyboard, so they are easily and quickly reachable. Dvorak layout is the most famous frequency based layout, however it was not adapted widely because a lot of people are already trained on qwerty keyboard.

For Urdu, National Language Authority (NLA) introduced a frequency based layout (shown in the figure). This layout is present in different versions of Microsoft Windows, however it does not gain popularity as people do not wish to learn another keyboard. Instead, phonetic keyboard layouts gained more popularity for Pakistani languages.

Figure 1: Frequency based Layout for Urdu[1]

1.2. Phonetic Layouts

The qwerty keyboard layout influenced the keyboard layouts of many languages that does not share the roman (latin) script. Many users, especially in Pakistan, start the use the keyboard for writing English (as English is the language of their computers' user interface). They start working on their native languages later, after gaining expertise on English user interface and keyboard layout.

[1] picture reference: https://commons.wikimedia.org/wiki/File:Urdu_keyboard_win.png

In this background, the phonetic keyboards are easier to learn for the users who are already using qwerty keyboard. In phonetic layout, the letters of the new language are placed on those keys of English qwerty layout that have the similar sound. For example, 'ب' is placed on 'b' and 'پ' is placed on 'p'. Hence, the user of phonetic keyboard does not need to memorise the position of keys, if she already knows the position of qwerty keys. Figure 2 has a phonetic keyboard in which the Urdu keys are shown along with the qwerty layout.

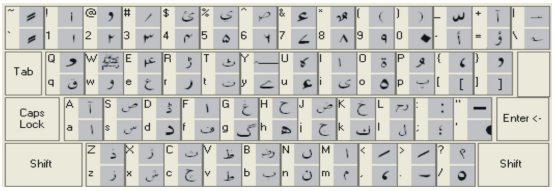

Figure 2: Urdu Phonetic layout along with the qwerty keys[2]

1.3. Roman Script based Keyboards

The memorization of letter position is not the only hurdle in adaptation of Urdu keyboard (and keyboards of other languages). Many users do not wish to spend time and resource for installing/setting up the native language keyboard. They use roman script for quickly writing Pakistani languages on computers and handheld devices. For this reason, roman script based systems are made that take input written in roman script and convert it to standard script of the language using list of words. Google Input Tools and Easy Urdu are examples of this type of keyboard applications.

2. Issues for Keyboard Layouts

After presenting different types of keyboard, we now list the major problems that cause difficulty of use and slow typing speed for Pakistani languages.

2.1. Number of letters

English has 28 letters. The letters are present in the three central rows of the keyboard. The total keys is these three rows are around 36 (12 in each row). The rest of the keys have punctuation and control characters.

Pakistani languages usually have a larger dataset e.g. Urdu has 39 (or more) letters. Hence all the letters cannot be placed on the central rows. The remaining letters are used by pressing the shift key along with the key of the letter. For example, pressing 's' key generates urdu 'س' and pressing shift+'s' gives Urdu 'ص'. In English keyboard, the shift key is used to write the capital letters. However for many Pakistani languages, the shift key is used to write those letters which do not find space on the keyboard. The frequent use of shift key lowers the speed of typing.

2.2. Phonetically Similar Letters

As described earlier that the phonetic keyboard help the user for not memorizing another keyboard layout. However, it is true only partially for many Pakistani languages. In many cases, there are more than one Urdu letters that can be mapped on one English key. For example, we have four Urdu letters that can be mapped on the 'z' key. Usually 'ز' and 'ذ' are placed on 'z' and shift-'z' keys. While 'ظ' is on shift-'v' and 'ض' is on shift-'j'.

Hence, the advantage of intuitive mapping of phonetic keyboards is not present for many letters.

Before the introduction of our keyboards, only roman script based keyboards solve this problem as they use the standard qwerty keys to write roman Urdu and then transform that roman word into Urdu script.

3. Mukammal Keyboard

We labelled our set of keyboards as Mukammal (complete) keyboard as all the letters are present on the screen. The system is made for android devices, however the same method can be used to create virtual keyboards on other platforms. The important innovations and features of our system are as follows.

3.1. Layout innovations

The keyboard layout for handheld devices is not bound to follow the physical layout of the keyboards of laptop and desktop computers. The keyboard appears on the screen and a developer can choose the number of rows and keys of the on-screen keyboard.

Hence, we did not restrict ourselves to the design (and number of keys) of the physical keyboard. We created five rows of keys in which each row has 11 keys. We placed 43 letters and 3 punctuation marks on the keyboard. The remaining keys are used for <enter>, <delete>, <space> and switching to English and Symbol layers of the keyboard.

This new layout solves the issue pointed out in section 2.1 i.e. all the letters are present on the screen and there is no need to use shift key while writing (almost all) the Urdu words. The switching to the symbol layer is required only to enter diacritical marks which are rarely written in Pakistani languages.

[2] picture refrence: https://commons.wikimedia.org/wiki/File:Urdukey.jpg

The issue of section 2.2 is also solved as we placed the similar sound keys closer to their QWERTY equivalent. Hence, we can see, in figure 3 and 4, that [,ز,ذ,ظ,ض] ,[ز,ذ,ظ,ض] and [ت,ث,ط,ة,ت] and [س,ص,ث,ش] are placed near to each other (and also near to their qwerty equivalent).

This is the major innovation that makes these keyboards different from other keyboards for Urdu and other Pakistani languages. Now the user does not need to use shift key and the required phonetically similar letter will be present in the vicinity of its qwerty equivalent.

3.2. Language based Predictions

The keyboard also increases the efficiency of typing by predicting the complete word and suggesting the next word.

For adding these features, unigram and bigram word lists along with their frequencies is used. The unigram word list is used to complete the word after some of its characters are typed. On the basis of typed characters, the system searches for the words that have the input sequence at their start. The list of such high frequency words is displayed over the keyboard, as shown in figure 3, and the user can click on the required word and avoid typing the whole sequence.

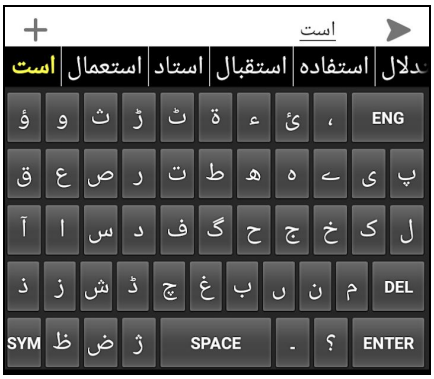

Figure 3: Word Completion in Urdu Keyboard

The words are stored as a tree to efficiently retrieve the complete words on the basis of input sequence. The word storage structure is efficient for both searching and storage space. This enables us to store a huge vocabulary and bigrams in just 3 MB of space. The other keyboards having vocabulary have larger size e.g. Easy Urdu keyboard is of 22 MB.

When a complete word is typed and space is pressed then the system provides a list of possible next words on the basis of bigram list, as shown in figure 4.

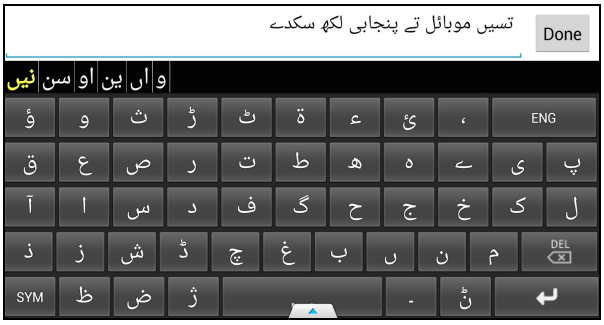

Figure 4: Next Word Prediction on Punjabi Keyboard

3.3. User Experience

The keyboards are present on the google play[3]. The Urdu keyboard is downloaded by more than 500K users and it has 4.1/5 rating on the basis 2,275 reviews. The Punjabi keyboard has more than 5K downloads and 4.5/5 rating on the basis of 37 reviews.

4. Future Work

The next step is to design similar keyboards for other Pakistani languages. It will involve creating new layouts, collecting corpora ro get unigram and bigram. The Sindhi is the biggest challenge as it has 52 letters and we need to one extra row to deal all the letters.

Moreover, the word completion is need to be improved. Currently, the words are suggested in isolation only on the basis of unigram frequency. However, we can use bigram frequencies to give the complete word on the basis of its context.

3 https://play.google.com/store/apps/details?id=dsu.crcl.urdukeyboard
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