ISSN (Print): 0972-2467
ISSN (Online): 0976-2477
SRELS Journal of Information Management, Vol 53(6), December 2016, p. 431-437 DOI: 10.17821/srels/2016/v53i6/98680

Soft Keyboards for the Kannada Language: A Case Study of Searching Library OPACs for Vernacular Content through Mobile Phones

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Abstract

Keyboards are the dominant Input Method Editors (IMEs) used for data input into computers. With the rise of mobile devices with touchscreen technologies, soft keyboards, also called 'on screen' or virtual keyboards, have become popular. The keyboard layout decides the data entry rate, user friendliness, and accuracy of data input. This study assesses ten soft keyboards in the Kannada language with respect to their utility for interaction with OPAC. EazyType Kannada and Google Keyboard were found to be better than others in terms of number of keystrokes required to input data. Anova and Standard deviation techniques were used to analyse the data. This study has an implication for users of OPAC in deciding the keyboard to be used on their mobile devices.

Keywords: Soft Keyboards, Onscreen Keyboards, Mobile Devices, Input Method Editors (IMEs), OPACs, Keyboard Layouts, Bibliographic Data Entry.

1. Introduction

India is a country of many languages. There are nearly 800 languages in India out of which 22 official languages are listed in the eighth schedule of Indian constitution[5]. While Hindi and English are official languages for Central Government offices, the state governments use their regional languages. There are little over 3.77 crore people with Kannada as their mother tongue[4]. Kannada obtained the status of a 'classical language of India' in 2008.

Kannada is said to be one of the oldest languages of the world. It is predominantly used in the state of Karnataka, although one may find people speaking Kannada in neighbouring states also. Kannada script evolved from Kadamba Script, which existed as early as 5th Century B.C.

It is surprising that in spite of glorious and a long history, the development of Kannada language computing is relatively slow. Computing in Kannada started with the development of InScript Keyboard by Centre for Development of Advanced Computing (CDAC) during the late 1980s. "The Government of Karnataka, Kannada Abhivriddhi Pradhikara, Kannada Ganaka Parishat and some of the IT workers having concern for Kannada have collectively strived hard in bringing out some user-friendly Kannada fonts and software. Some of the important Kannada fonts and software are Nudi, Baraha, Ileap, Srilipi, Akriti, Kairali, Prakashak, Brahmi, Kuvempu, Kannada Kacheri, Kannada Saurabha, Kalitha,etc. Apart from these Shabdaratna, KaBaraha, Leaplight, Leap Office are the Kannada related software in use[13].

The present study is an exploratory one comparing the mobile-based Input Method Editors – (IMEs) regarding the keystrokes required to enter bibliographic data required for interacting with the OPACs. Most of the IMEs for mobiles are in the form of soft keyboards – also called virtual or on-screen keyboards. Soft keyboards replace the hardware or physical keyboards on a computing device with an onscreen image map[16].

2. Review of Literature

Keyboard layout analysis is the subject of research of many studies. The literature on the subject may be classified

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into two groups. Those studies which concentrates on the study and assessment of individual IMEs and those that compare different IMEs.

The most popular keyboard layout is QWERTY. The layout was developed to suit the mechanical typewriter more than 140 years ago. In 1971 the International Standards Organization recognised QWERTY as the Standard keyboard[11] and continued to be widely used[12]. The design of the layout was suggested by Christopher L. Sholes in 1968[15].

Comparing the keyboard layouts to assess the efficiency of each is a matter of interest to researchers. Being the popular keyboard layout, QWERTY forms the part of many comparison studies[3,6,7,14]. Most of the studies show that QWERTY is a less efficient layout.

Buzing (2003)[3] has compared QWERTY, Dvorak and alphabetical keyboard layouts and highlights the limitations of QWERTY layout which was designed for mechanical reasons. His study concludes that Dvorak does produce a better typing speed but only to the extent of 4 to 5%. In their study[15] of the soft keyboards, the researchers have shown that Alpha layout is slightly better than the QWERTY in typing improvement (learning), error rate, and typing speed.

There are a few studies on Indic keyboards also. Most of the studies concentrate on the single keyboard layout[2,8,9]. There are, on the other hand, a few comparative studies on Indian keyboards[1,10].

The present study focuses on the assessment of ten soft keyboards for entering the bibliographic data in OPACs.

3. Input Methods for Kannada Scripts

Input methods for Kannada scripts in digital devices are not as direct as that of Roman scripts. There are three ways in which the Kannada keyboards are structured. Based on the method of inputting the Kannada script, the keyboards can be classified into three groups:

- Phonetic/Transliteration: In this method of input, the Kannada scripts are entered using the usual QWERTY keyboard. The inputter enters the Kannada character using phonetically converting the character into as equence of Roman letters. For example, ka to enter "ಕ", ki for "ಕಿ" and so on. The advantage of this method is that the same standard keyboard can be used both for Roman and Kannada scripts. But, one of the major disadvantages of this method of input is that the user should know the correct transliteration sequence for typing a character. Sometimes it may be a bit tricky. For example, for "ಜ್ಞ", whether one should use "jna" or "gnya" depends on the transliteration software used.

The phonetic transliteration input tools are further classified into two groups.

A) **Fixed transliteration scheme based tools**: These tools are based on the pre-defined transliteration table, which prescribes the sequence of Roman letters to be used for inputting Kannada characters. They work using a fixed transliteration scheme to convert text. The example given in the above paragraphs falls in this category.

B) **Intelligent/Learning based transliteration tools**: This is an extension of the above category with an additional smart feature. This keyboard uses an auto suggest method while inputting the words. If the autosuggest is ignored by the user, it works just like the fixed transliteration scheme tool. The intelligent tool/ keyboard compares the word with a dictionary and then converts it to the equivalent words in the target language.

- InScript: InScript is the standard keyboard for Indian languages. Developed by C-DAC and standardised by Government of India. Nowadays it comes inbuilt in all major operating systems including Microsoft Windows, Linux and Macintosh. The keyboard structure, it is claimed, is based on scientific analysis and thus helpful for speedy typing. Figure 1 shows the structure of the InScript keyboard.
- Numeric Keyboard: The basic models of mobile phone have only 12 keys with a facility to type the alphabets with the multi-tap method. This type of keyboard is not considered as the efficacy of such keying is obviously less.

The keyboards may also be classified as physical and virtual. The physical keyboards are the conventional hardware-based keyboards, whereas the virtual keyboards are displayed on the touch screen device. Virtual keyboards, also called soft keyboards or online keyboards, are on the increase and have replaced the conventional keyboards in handheld devices such as mobile phones.

Keyboard layout normally refers to the arrangement in which the characters are arranged on the keyboard. QWERTY layout is the most common layout for Roman script based keyboards. Though CDAC has come out with scientifically developed InScript layout (Figure 2) for Indian languages, the soft keyboard developers have come out with different keyboard layouts. However, a few developers - such as Google, Hitap, and so on - have adopted the InScript layout.

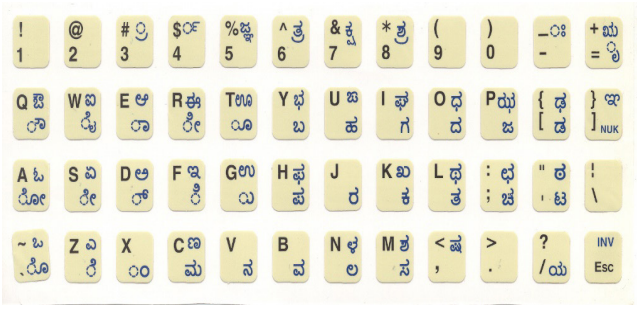

Figure 1. InScript Keyboard.

As far as Kannada is concerned, the layout developed by K.P. Rao of Baraha has become popular. "He developed a novel keyboard overlay for Kannada, which follows the most scientific and structured property of the Kannada script. Baraha has adopted this design for all the Indian languages by making a few minor changes to address the language specific issues"[2]. Figure 2 shows the keyboard layout of Baraha. This layout is followed in other soft keyboards also with minor changes. Some of them are Indic, Just Kannada, Anysoft and Kannada Keyboard.

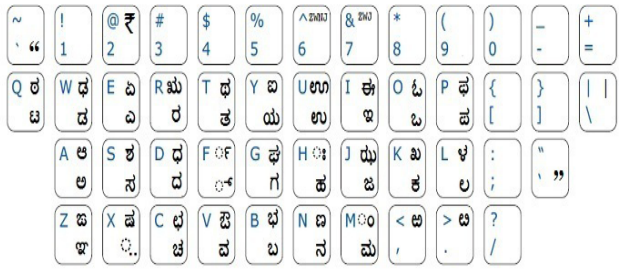

Figure 2. Baraha keyboard layout developed by K.P. Rao.

Apart from the above two layouts, some layouts follow the arrangements of the vowel keys to match with the order in which they appear in the Kannada language. The Swarachakra layout developed by Indian Institute of Technology, Bombay is an example for using the pure alphabetical sequence for the keyboard layout also. So is Sparsh Kannada. Figure 3 shows the layout.

Figure 3. Keyboard layout with vowels in the same order as that in the Kannada language.

4. Methodology

The present study is to understand the usability of various Kannada soft keyboards compatible with Android mobiles. It may be noted that a variety of keyboards available for computers are not available for mobile phones. Hence, only those that are amenable for inputting data in mobile in Kannada language are considered. Table 1 gives a list of keyboard apps that could be used for searching OPACs in Android mobile phones.

Table 1. List of soft keyboards in the Kannada language

Sl. No.	Keyboard List	Sl. No.	Keyboard List
1	Akshara Kannada keyboard	11	Just Kannada keyboard (KB 5)
2	AlphAkshara keyboard	12	Kannada for Anysoft keyboard (KB 6)
3	Chrooma keyboard	13	Kannada keyboard (KB 7)
4	EazyType Kannada keyboard (KB 1)	14	Kannada-Hindi keyboard
5	English Kannada keyboard	15	Lipikaar Kannada keyboard (KB 8)
6	Frontype	16	Panini keyboard Kannada
7	Google Indic keyboard	17	Sparsh Kannada keyboard (KB 9)
8	Google keyboard (KB 2)	18	Swalekh Indic keyboard
9	Hitap Indic Kannada keyboard (KB 3)	19	Swarachakra keyboard (KB 10)
10	Indic keyboard (KB 4)	20	Swiftkey keyboard Kannada

Note: The text in the brackets shows the codes used in this study and only those have been studied.

Unlike in computers, all the mobile phone apps relating to Kannada language input as shown in Table 1 use virtual keyboard method for inputting the data.

Only ten keyboards are considered in the study. They are indicated in Table 1 with the code given along with them in the parenthesis. All these keyboard apps have been downloaded, and the Mysore University OPAC has been accessed through them.

The details of the keyboards are given in Table 2. One may observe from the table that all the keyboard apps are quite popular and have been downloaded / installed at least 10000 times. The details have been collected by the researchers while installing the apps in their mobile. Going by the installation numbers, one may find that the Kannada keyboard apps are being used by people on a large scale. The keyboard apps are also regularly revised by their developers.

5. Soft Keyboards and Searching of OPACs

Online Public Access Catalogues – OPACs for short – are the gateway to library resources. With the advent of Unicode standard, the bibliographical data in languages other than English are increasingly being entered in their respective scripts. Earlier, the non-English bibliographical details were being entered in the online catalogues in transliterated form. The availability of Unicode font has changed the scenario. The OPACs are now a multi-language resource for searching and browsing library resources.

One of the issues with the users of OPAC is to enter the data in the respective languages for searching the materials. Data entry in Indic languages in general and Kannada, in particular, is not as straightforward as entering the English text. A character in Roman script of English language will consume only one-character point in ASCII /Unicode encoding standards. A character in Kannada, on the other hand, is split into more than one Unicode code points. Hence, for example, "ಕನ್ನಡ" would consume five Unicode code points. While typing the Kannada scripts there are also variations in the method of typing depending upon the IMEs used. The present study was conducted to explore the extent of variations that one would find in the IMEs for android mobile phones.

For checking the effectiveness of each of the ten IMEs considered in the study, the researchers collected the titles of 56 books available in the Mysore University Library. The books were selected randomly by picking the first and the last books from each row of the Kannada section. There were 28 rows available and hence 56 books were

Table 2. Details of soft keyboards in Kannada for android phones

Sl. No.	Keyboard Name	Developers	Current Version	Installation	Updates
1	EazyType Kannada Keyboard	SRCTechnosoftPvt. ltd. contact@srctechnosoft.com	3.0	50,000-100,000	July 8,2015
2	Google-Keyboard	Google Inc. appshelp@google.com	4.1	100,000,000-500,000,000	February 25,2016
3	Hitap Indic Keyboard	Funny tap tech contact@funnytap.com	1.9.1	500,000 +	May 17,2016
4	Indic Keyboard	Indic project contact@smc.org.in	2.04	100,000-500,000	March 22,2016
5	Just Kannada Key-board	Just Indic Justindickeyboard@gmail.com	4.1.1177	100,000-500,000	April 3,2016
6	Kannada for AnySoft-KeyBoard	Menney Even Danan ask@evendanan.net	Version with device	50,000-100,000	July 8,2015
7	Kannada keyboard	Android Veena veenaramilli@gmail.com	1.3	50,000-10,0000	February 22,2016
8	Lipikaar Kannada keyboard	Lipikaar support@lipikaar.com	Version with device	10,000-50,000	January 27,2016
9	Sparsh Kannada keyboard	Sparsh team sparshkb@gmail.com	2.10	100,000-500,000	February 1,2014
10	Swarachakara Kannada keyboard	Swarachakra team IDC, IIT Bombay	2.01	10,000-50,000	September 25,2014

selected. The books are represented as title1, title2, etc. These titles are entered through all the IMEs selected for the study and the number of keystrokes required to enter the details was noted.

6. Analysis

The main focus of this study is to find out the efficiency of the IMEs by counting the number keystrokes required for entering the randomly selected data. The number of keystrokes required for entering the title for each of the ten IMEs is tabulated in Table 3. The standard deviation and mean of the keystrokes were computed. The coefficient of variance was calculated.

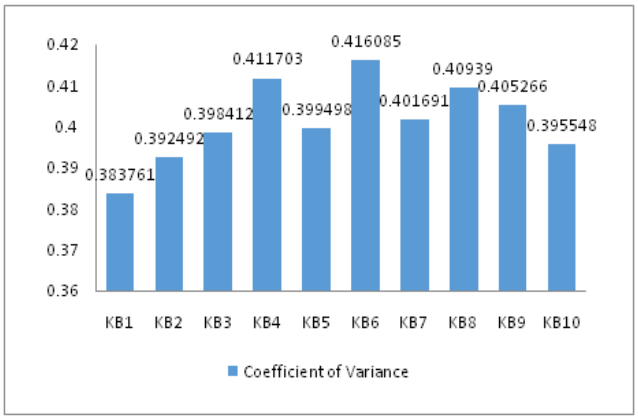

Figure 4. Keystroke distribution in different keyboards for titles Keystroke distribution in different keyboards for titles.

Table 3 shows the number of keys required for each of the ten keyboard IMEs used in the study. The data reveals that Swarachakra keyboard requires fewer keystrokes than the other keyboards. However, the experience of the researchers shows that the design of the Swarachakra keyboard is not conducive for speedy data entry. A time-motion study is required to establish and authenticate this particular experience of the researcher. Google Keyboard (KB2) is the second in the minimum keystroke requirement. The experience of the researchers shows that as Google Keyboard uses the autosuggest mode also, and probably the users of the OPACs may find it quite useful for entering the data into the OPAC search field.

As far as the variations in entering the data are considered, EazyType Kannada Keyboard has the minimum coefficient of variation. It recorded the coefficient of variation to be 0.383761 which is minimum in the data set. Google Keyboard occupies the second position with 0.392492 as the coefficient of variations. EazyType Keyboard has some issues while typing.

It is surprising to note that out of the ten keyboard IMEs, only one – Kannada Anysoft keyboard has ZWJ and ZWNJ characters which are essential for entering words like "ರಾಜ್‌ಕುಮಾರ್", "ಎನ್‌ಸಿಸಿ", "ಐನ್‌ಸ್ಟೈನ್", and so on.

ANOVA was tested for the data set to find out whether the difference between the sets is statistically significant. The calculations are shown in Table 4.

The F value is much higher than the F-crit meaning thereby that there exists a significant difference between the keyboards as far as data entry is concerned.

The efficiency of the keyboards for entering the Kannada titles needs to be further tested. A more extensive study is required to establish the good IMEs for interaction with OPACs. The old Kannada script entry needs to be tested. The present study did not attempt to test the efficacy of the IMEs for old Kannada scripts. Similarly, separate research is required to compare these keyboards on parameters like musical notes, characters with diacritical marks and so on.

7. Conclusion

The development of character encoding standards has resulted in an increase in content in various languages in the world. As far as Indic language content is concerned, the development of ISCII and Unicode has a direct impact on the increase in regional language content. One of the main issues is the input tool available for entering the textual data into the computer system or mobile devices. The developers of IMEs have adopted the QWERTY keyboard structure to suit the Indian requirements. Research need to be conducted to test various keyboards.

Thanks to the developments in virtual keyboards / soft keyboards, every language has its keyboard for data entry. Kannada is no exception to this. In fact, the issue is now the problem of plenty. There are as many as 20 keyboard apps in Kannada. The question now is which one is better for them and particularly for interacting with OPACs of libraries.

This study is undertaken to examine and compare ten popular keyboard apps in Kannada. It is found all of them could be used for interacting with OPACs. However, a few of them are better than others in terms of speed of data entry and consistency of keystrokes. The data collected for the study clearly, demonstrates that EasyTypeKannada and Google Keyboard are found to be convenient and efficient among the keyboards considered in the study.

A more detailed study is required to study the keyboards from different parameters such as speed, error rate and ease of learning.

Table 3. Keystroke distribution in different keyboards for titles

	KB1	KB2	KB3	KB4	KB5	KB6	KB7	KB8	KB9	KB10
Title 1	25	19	19	21	20	21	28	21	38	19
Title 2	43	37	37	41	42	48	47	37	66	31
Title 3	27	18	20	20	19	22	27	23	40	18
Title 4	17	12	12	14	14	17	13	14	25	12
Title 5	25	20	20	20	21	28	28	22	37	19
Title 6	15	15	13	13	15	18	15	15	22	12
Title 7	22	23	23	24	24	26	31	23	33	22
Title 8	35	28	28	29	29	37	36	33	39	25
Title 9	25	20	20	20	22	21	22	24	45	17
Title 10	24	15	14	20	20	15	25	20	27	16
Title 11	28	25	27	27	26	31	30	27	41	22
Title 12	19	19	19	23	23	29	26	31	35	16
Title 13	29	27	27	26	29	31	31	27	49	22
Title 14	26	14	22	23	27	27	33	28	34	21
Title 15	22	19	19	21	22	24	24	22	41	18
Title 16	30	22	22	24	25	25	27	24	47	20
Title 17	26	19	21	22	23	20	27	22	40	21
Title 18	32	29	28	32	32	35	36	32	55	28
Title 19	30	24	26	26	27	30	31	27	56	24
Title 20	18	11	11	11	13	13	11	11	17	9
Title 21	23	17	17	18	18	19	23	17	30	16
Title 22	16	12	13	14	13	14	14	15	25	12
Title 23	21	13	13	14	14	14	19	13	23	13
Title 24	33	24	26	27	25	31	29	27	55	24
Title 25	16	12	13	13	15	16	17	15	18	11
Title 26	20	14	14	14	15	14	19	14	38	14
Title 27	23	17	16	18	21	19	24	19	31	17
Title 28	15	11	11	11	14	12	15	9	17	10
Title 29	21	18	19	18	20	20	24	19	37	18
Title 30	21	20	19	17	19	22	25	23	30	19
Title 31	14	11	11	12	11	11	12	11	24	8
Title 32	11	8	8	8	9	8	14	12	20	8
Title 33	17	15	15	15	17	16	17	16	19	14
Title 34	16	14	14	14	14	16	23	15	22	14
Title 35	39	17	17	18	19	20	21	21	37	16
Title 36	22	22	22	24	26	26	25	28	42	21
Title 37	19	16	16	16	16	17	20	18	38	15
Title 38	17	14	14	14	15	16	18	15	21	13
Title 39	16	13	12	13	14	15	13	13	18	11
Title 40	20	14	14	14	15	17	18	16	24	13
Title 41	9	6	7	7	6	9	6	7	8	5
Title 42	25	26	27	26	25	30		28	51	25
Title 43	17	13	13	13	14	13	17	17	33	13
Title 44	21	18	18	20	21	21	26	18	28	17
Title 45	12	9	8	10	10	11	13	11	20	8
Title 46	26	16	16	17	16	20	20	19	27	15
Title 47	40	26	25	27	28	27	40	28	46	27
Title 48	16	11	13	13	14	14	19	13	23	13
Title 49	37	34	34	35	34	40	35	37	48	31
Title 50	19	17	17	17	17	17	24	17	32	17
Title 51	39	33	35	38	39	40	42	39	60	33
Title 52	48	36	36	41	40	39	53	42	81	36
Title 53	20	16	15	17	17	20	18	18	29	15
Title 54	49	35	37	41	44	46	47	48	56	35
Title 55	10	11	10	11	12	11	15	10	19	10
Title 56	17	13	13	14	14	26	14	16	29	12
Total key strokes	**1323**	**1038**	**1056**	**1116**	**1154**	**1245**	**1327**	**1187**	**1946**	**991**
Standard Deviation	9.0663	7.275115	7.512914	8.204653	8.232511	9.250465	9.691711	8.677598	14.08298	6.999795
Average	23.625	18.53571	18.85714	19.92857	20.60714	22.23214	24.12727	21.19643	34.75	17.69643
Co-efficient of Variance	0.383761	0.392492	0.398412	0.411703	0.399498	0.416085	0.401691	0.40939	0.405266	0.395548

Table 4. Anova: single factor

Anova: Single Factor						
SUMMARY						
Groups	**Count**	**Sum**	**Average**	**Variance**		
KB1	56	1323	23.625	83.69318		
KB2	56	1038	18.53571	53.88961		
KB3	56	1056	18.85714	57.47013		
KB4	56	1116	19.92857	68.54026		
KB5	56	1154	20.60714	69.00649		
KB6	56	1245	22.23214	87.12695		
KB7	55	1327	24.12727	95.66869		
KB8	56	1187	21.19643	76.66981		
KB9	56	1946	34.75	201.9364		
KB10	56	991	17.69643	49.88799		
ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F-crit**
Between Groups	12137.82	9	1348.647	15.98521	2.33E-23	1.896924
Within Groups	46318.25	549	84.3684			

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