Computer Engineering and Intelligent Systems
ISSN 2222-1719 (Paper) ISSN 2222-2863 (Online)
Vol 3, No.4, 2012 

# Efficient Cell Phone Keypad Designing for Bangla SMS Using English Alphabets

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**Abstract**

Mobile phone networks are increasingly supporting the transmission of textual message between individuals. In this paper we have introduced a new approach that will enhance the speed of typing process in Bangla by using English mobile keypad. An example of making Bangla sentences using English keypad could be "Ami valo achi". Traditional cell phone keypad is not suitable for Bangla typing using English alphabets and number of key pressing is high to make such Bangla SMS (Short Message Service). The proposed approach has been explored to speed up the typing process in Bangla using English alphabets. The alphabets are rearranged according to the priority of frequencies. The frequency of alphabet is appeared by most used letter in SMS. The letters which are mostly used are recognized as higher frequency. The proposed design consumes less time for typing Bangla SMS using English letter format.

**Keywords:** Mobile keypad, unitap, multitap, Bangla SMS, frequency.

## 1. Introduction

Today SMS messaging and chatting have become basic needs for our daily needs to share information. Cell phone networks are increasingly supporting the transmission of textual messages between cell phones (e.g. SMS, chat, etc.). It is reasonable to envisage increased use of these facilities and increased integration with other electronic services such as e-mail. However, the use of textual messages from mobile phones is inherently limited by the very poor text input facilities: cell phones only have 12 main keys with 3-10 additional function keys. At present cell phone has become the main communicating device of people. Since it is people's common device, so it needs to make more and more flexible and easier to use. Tremendous efforts that have been made to make cell phone more and speedier but a little effort has been made to enhance its input interface by using keypad. In this situation we are motivated to propose a cell phone keypad layout, which will be both flexible and speedy.

With the increase in the usability of cell phone, the manufacturers have designed different types of keypad layouts. Currently available cell phones keypad design technologies are basically of two types. They are categorized on the basis of key tapping. One is Unitap and the other is Multitap. Uniatp works on the technique of single pressing for any alphanumeric character. It provides full computer keyboard functionality with flexible design. Several mobile phones have been designed by using a miniature version of the QWERTY keypad called small QWERTY keyboard, with the same layout but less densely packed smaller keys [1]. Because of their smaller size, most users cannot use all ten fingers simultaneously to enter text, as it is typically done on full-sized QWERTY keyboards [2]. Manufacturers [3] have designed micro sized QWERTY keypad, which is flexible for two hand operation [1, 3]. Some company has developed Fastap architecture [4,5] by arranging the numeric keys surrounded by the alphabetic keys. Multitap technology is the currently available most frequently used keypad layout. It requires multiple tapping for each character. It arranges the characters in alphabetic order. Each key has three or four characters. This type of layout is used by the leading manufacturers like Nokia, Samsung, Motorola, Erricson etc. Another type of keypad layout is designed known as MessagEase [6] based on Multitap technology. Completely enhanced cell phone keypad [7] suggests a keypad for cell phone and other cellular device based on the frequency of the alphabet in English language and also with the view of structure of human finger movements to provide flexibility. Using tilt for text input to mobile phones [8] make the results of a controlled experiment comparing TiltText to MultiTap, the most common text entry technique. The results show that text entry speed including correction for errors using TiltText was 23% faster than MultiTap. An evaluation of mobile phone text input method [9] which presents an empirical study that compares three mobile phone text input techniques. The methods are multi-press input with timeout, multi-press input with a next button and two-key. The studies show that significant speed difference in words per minute (wpm).

SMS is the cheapest and popular technology in cell phone communication. In Bangladesh all peoples speaking in Bangla and normally send SMS or chat each other in Bangla using English letters. For example, "Tumi kemon acho?" There are lots of problems in our traditional keypad for sending SMS in Bangla. This process has become most popular for Bangladeshi. But the traditional cell phone keypad is not suitable for typing in Bangla using English alphabets. For example, when we type the word 'kemon' we need to press 55 33 6 666 66 which take10 key pressing and needs very long time. Because the letters arrangement in traditional keypad is not so good to typing Bangla sentences using English alphabets. In this paper we have design new keypad layouts for cell phone, where English alphabets has been rearranged according to the frequency basis, i.e. the more frequently used letters have been placed at the first, second or third position of each key, respectively. If the keypad is rearranged by the proposed method, there will be take comparatively minimum number of key pressing to type the required SMS. As a result all Bangladeshi will be interested and feel comfort to send Bangla SMS in English letter format. Also, this SMS system will be easier and less timing for us.

## 2. Analysis and Design

There are various techniques to design for cell phone keypad, which have been discussed in previous section. Different ways have different rate of efficiency. But all of them have been designed, on the basis of cell phone keypad, which are efficient for English typing using English alphabet. The main objective of this paper is to develop a convenient way to design the cell phone keypad layout, which will be efficient for typing process in Bangla (e.g. "tumi kemon acho?") using English alphabet. To achieve above objective sample data (SMS) has been collected from different persons and they are with different professions and different ages. After find out the frequencies or occurrences of each letter, they have been rearranged according to the frequency basis.

The following steps that have taken to design the proposed approach:

1. Data collection
2. Then the frequencies of each letters are calculated by counting occurrence of each character from collected data.
3. Then a new cell phone keypad is designed based on the frequency of letters which would be suitable & speed up by minimizing the number of key pressing for the people specially Bangladeshi.
4. Last of all, carrying out experiment to analyze the system.

*2.1 Data Collection:* SMS have been collected from the different mobile users. The collected SMS are called sample data. Sample data have been needed to find out the occurrence of each letter. There are various categories of mobile user such as student, businessman, employee, housewife etc. Among them SMS is very popular communicating media in young generation. For the proposed architecture, approximately 1000 SMS have been collected from 50 different people. The observation has been made on 977 SMS. Now 977 SMS contains 55337 characters (letters), which is the total amount of data in the training data set.

*2.2 Finding Frequency:* We have followed simple algorithm to find out the frequency of each letter and figure 1 shows the frequency calculating algorithm. Frequency of a letter is how many times a letter is occurred in training data set. Mainly this algorithm counts the occurrences of each letter in training data, by eliminating all spaces, digits, punctuations and so on i.e. this program count only alphabet and find out the frequencies of each letter. Finally show three outputs: total alphabets, frequency of each letter and their percentage.

Those letters are more frequently used which have higher frequency. This is needed because the proposed keypad layout has been designed by arranging the more frequently used alphabets in first position of each key where table 1 shows the percentages of occurrence of each letter in sample data.

To arrange alphabets in the proposed layout, higher frequency have got the higher priority. So table 1 has been rearranged again according to increasing order of frequency percentage and the new result has been shown in table 2. The letters which have the higher frequency or higher percentage have been identified as more frequently used letter. From the table 2 we see that most frequently used letter is ‘a’ and least frequently used letter is ‘q’.

*2.3 Proposed Design:* In traditional keypad, all of alphabets are accommodated in eight keys (labeled 2-9). Each key contains three or four letters. Number of key pressing for a letter is equal to its positional value. That means,

Number of key pressing for 1$^{st}$ positioned letter is one.

Number of key pressing for 2$^{nd}$ positioned letter is two.

Number of key pressing for 3$^{rd}$ positioned letter is three and so on.

In proposed architecture the keypad layout is designed by arranging the priority of higher frequency of letter. The frequencies have been calculated because the letter that is most frequently used has been placed at the first position of the key labeled 2, in cell phone keypad. Then the letter, which is next most frequently used letter, has been placed at first position of the key labeled 3. In this manner, the first eight most frequent letters have been placed in the first position of eight keys i.e. labeled 2-9. This arrangement shows that no longer time requires pressing the letters that is frequently used. However, again, the next eight most frequent letters have been placed in the second position of those keys. In this way, all letters are placed at first, second and third positions according to priority of frequencies. The letters, which have been placed at third and fourth position, are less frequently used letters. As they are less frequent, they will be less pressing for the user. Table 3 shows how the alphabet is arranged.

Again the table shows that after arranging the letter according to the priority of frequencies, the key ‘2’ contains (a, n, j, x) where traditional keypad contains (a, b, c). In this manner, key ‘9’ contains (tcz) where traditional keypad contains (wxyz). Furthermore we find that number of key pressing is one for 1$^{st}$ positioning letter such as a, o, e, i, r, h, k, t and in this way number of key pressing is four for 4$^{th}$ positioning letter x, q. The proposed keypad layout after arranging the alphabets is shown in figure 2. The design will be efficient and flexible for the people who are familiar with Bangla SMS using English letters.

## 3. Experimental Results and Discussion

By the proposed keypad layout mobile users will find the frequently used letter easily with minimum number of key pressing. In this section, we have discussed the resultant issues on the design. A comparison has been made to find out the performance of our proposed keypad with traditional keypads.

*3.1 Comparison with Traditional Keypad:* To compare the proposed design with traditional keypad, an experiment has been made on 10 test SMS. The number of key pressing have been calculated in the proposed keypad and compared this result with the traditional keypad using the test SMS. Following are the test SMS-

1. SMS1="suvo noboborsho"
2. SMS2="ei shoptahey 3 jon bijoyee pelo mobile set. Apnio handset jite nitey paren"
3. SMS3="Banglai sms likhtey pochondo kori"
4. SMS4="amar mon khusi tey vorey gelo"
5. SMS5="amra thakte apni keno ei kaj korben"
6. SMS6="aj pohela boishakh suvo noboborsho"
7. SMS7="ami valo achii"
8. SMS8="sobai mileyek sathe kaj korley kono badhai thakena. Kotin kaj o sohoj hoye jai"
9. SMS9= "prio grahok, apnar balance ekhon sunno."
10. SMS10="ami ekhon besto"

The evaluation of one SMS in traditional keypad and proposed keypad are shown in table 4. We have considered the text SMS "suvo noboborsho" to carry out our experiment. In traditional keypad, to type letter 's', we required 4 key pressing. So on to complete typing of this SMS we need total 39 key pressing. While in proposed layout, to get letter 's', number of key pressing will be only 2 and total number of key pressing is 22. From the numerical data we found that number of key pressing has been reduced by 17 in proposed layout and the reduction rate is 43.59%.

Now to compare the number of key pressing by above mentioned, 10 test SMS which is shown in the table 5. It shows that key pressing has been reduced to 34.481% in proposed layout. This is radical change in typing the text massage in Bangla using English alphabet.

From the analysis, it has been observed that the number of key pressing for the traditional keypad is much higher than our proposed frequency based keypad layouts. As the proposed keypad design requires less key pressing hence, it is less time consuming and thereby increase the typing speed.

## 4. Conclusion

Wireless services are increasingly ubiquitous and essential components in the global communications infrastructure. The mobility, flexibility, and reconfigure ability of wireless offer compelling complements, at times and that substitute for wired infrastructure. They enable many new services and expand the usability of old services, extending the ability to stay connected anywhere and anytime we desire. This study has been build up a new keypad design, which is convenient and speed up typing process in Bangla using English alphabet keypad. Speeding up the typing process the alphabetic arrangement has been required to be changed to greater extent. In this proposed keypad layout as the frequently used letters are arranged in the first and second position of each key, it will be convenient and time consuming for typing in Bangla using English alphabets. It is found that the number of key pressing in our proposed keypad is lower than the traditional keypad, which cause less time consuming for entering text and increase the speed of typing process. From experimental result, success rate around 34.481% is achieved by reducing key pressing. The users will be benefited to great extent as soon as they become extended to it.

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## Appendix

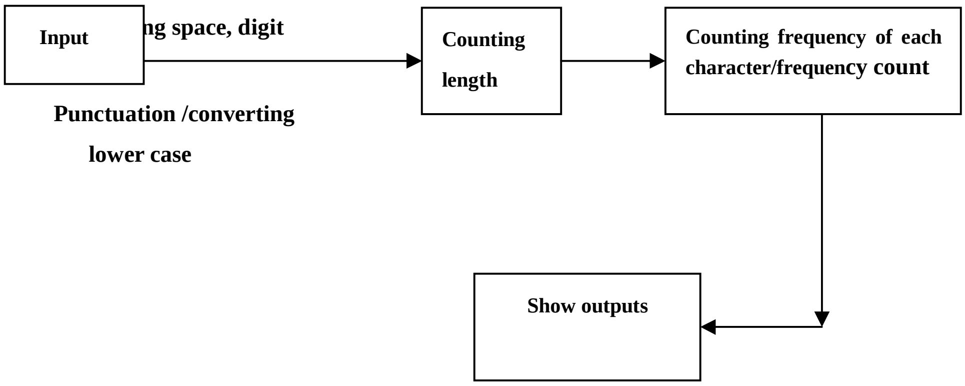


**Figure 1**: Block diagram of frequency calculating algorithm

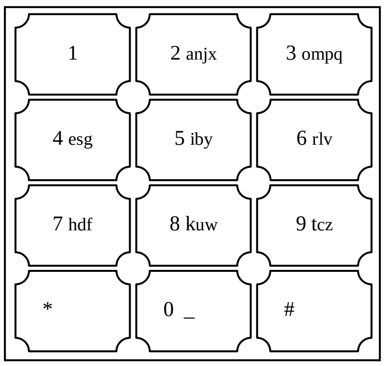


**Figure 2:** The proposed frequency based cell phone keypad layout

**Table 1:** Frequency of the alphabets in training data set

| Alphabets | Frequency in percentages | Alphabets | Frequency in percentages |
|---|---|---|---|
| a | 14.626 | n | 5.25 |
| b | 3.834 | o | 9.728 |
| c | 2.14 | p | 1.843 |
| d | 2.554 | q | 0.049 |
| e | 8.04 | r | 6.283 |
| f | 0.414 | s | 4.174 |
| g | 1.385 | t | 5.727 |
| h | 5.974 | u | 2.195 |
| i | 7.947 | v | 0.575 |
| j | 1.88 | w | 0.297 |
| k | 5.869 | x | 0.118 |
| l | 3.203 | y | 1.373 |
| m | 4.378 | z | 0.142 |

**Table 2**: Percentage of frequency of each character in increasing order

| Alphabet | Frequency (%) | Alphabet | Frequency (%) |
|---|---|---|---|
| a | 14.626 | d | 2.554 |
| o | 9.728 | u | 2.195 |
| e | 8.040 | c | 2.140 |
| i | 7.947 | j | 1.880 |
| r | 6.283 | p | 1.843 |
| h | 5.974 | g | 1.385 |
| k | 5.869 | y | 1.373 |
| t | 5.727 | v | 0.575 |
| n | 5.250 | f | 0.414 |
| m | 4.378 | w | 0.297 |
| s | 4.174 | z | 0.142 |
| b | 3.834 | x | 0.118 |
| l | 3.203 | q | 0.049 |

**Table 3:** Arrangement of Alphabet

| Keys | Alphabet | | | |
|---|---|---|---|---|
| 2 | a | n | j | x |
| 3 | o | m | p | q |
| 4 | e | s | g | |
| 5 | i | b | y | |
| 6 | r | l | v | |
| 7 | h | d | f | |
| 8 | k | u | w | |
| 9 | t | c | z | |

**Table 4:** Comparison of number of key pressing with an example.

| Example / Number of keypressing | S | u | v | o | | n | o | b | o | b | o | r | s | h | o | Total number of key pressing | | Reduction in proposed layout | Reduction (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in Traditional keypad | 4 | 2 | 3 | 3 | | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 4 | 2 | 3 | = | 39 | 17 | 43.59% |
| in Proposed keypad | 2 | 2 | 3 | 1 | | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | = | 22 | | |

**Table 5:** Comparison of number of key pressing with 10 test SMS in traditiona and proposed layout.

| Test SMS | Number of key pressing in | | Key pressing reduced | Parcentage | Average |
|---|---|---|---|---|---|
| | Traditional keypad | Proposed layout | | | |
| SMS1 | 39 | 22 | 17 | 43.59% | 34.481% |
| SMS2 | 126 | 92 | 34 | 27% | |
| SMS3 | 67 | 45 | 22 | 32.84% | |
| SMS4 | 54 | 38 | 16 | 29.63% | |
| SMS5 | 54 | 39 | 15 | 29.63% | |
| SMS6 | 74 | 45 | 29 | 39.19% | |
| SMS7 | 27 | 17 | 10 | 39.28% | |
| SMS8 | 128 | 91 | 37 | 34.06% | |
| SMS9 | 69 | 48 | 21 | 30.43% | |
| SMS10 | 28 | 17 | 11 | 39.29% | |