Myanmar Syllable Suggestion Input Method on Android Smart phone

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Abstract

It has been understood that text entry on mobile phone can only be speed up with the aid of prediction mechanism. This paper proposed intelligent syllable prediction Input Method Editor (IME) for Android touch screen mobile phones by taking the leverage of the Position Aware Matching Model (PAM) and Statistical Language Model (Bi-gram Model). The experimental results indicate that the proposed system outperforms the conventional Myanmar soft keyboard on Android (without prediction technology embedded: MyanDroid.apk) with a 50% improvement in inputting performance and the input speed.

Keywords: text entry, Mobile phone, Soft Keyboard, Touch Screen

1. Introduction

Today, mobile phone trend have changed to smart phone dramatically. As a result, the early day Multi-tap's difficulty of multi Key Stroke per Character (KSPC > 1) can be reduced to one Key per Character (KSPC = 1) [3]. Meanwhile, touch screen keyboards utilize an on-screen virtual keyboard that is software-based. Thus, they can adapt easily for effective input. There are many ways to reduce KSPC efficiently such as key mapping and keypad Layout [7]. However, to have more efficient KSPC, this virtual keyboard needs to be embedded with some character prediction, word prediction, Part of Speech (POS) prediction, multimodal feedback, word completion and auto-correction techniques. There are many word prediction IME for different languages such English (LatinIME), Japanese (JapaneseIME), Greek (GreekIME), Chinese (PinyinIME and ZhuyinIME), etc. However, prediction text entry system for Myanmar language has not been tried out not only in mobile phone application but also in desktop one. This paper proposed Myanmar syllable prediction system to be used in mobile touch screen phone.

In smart phone technology market, Apple's iPhone and Google's Android are popular now. Although, due to developer cost, iPhone technology is too high to develop for university student level. Google start launched a mobile platform Android in November 2007 as a form of open source platform. It is based on the Linux operating system and all necessary software for a mobile phone. At the same time, Android SDK (Software Development Kit) provides some necessary tools and API for the application development on Android platform with Java language and release without obstacle version of ADT and SDK annually. The proposed IME is developed on Android platform to avoid iPhone's developer fees. The following of the paper is organized as follows. Related work of the proposed system is described in Section 2. After that, Section 3 is the place of problem statement of the proposed IME. Implementation of the proposed system design is explained in Section 4. Experimental results are discussed in Section 5. The last section is devoted to conclusion and further extension.

2. Related Work

Yao Xia-xia [5] proposed a realization of Chinese input based on Android with C

language (native language) rather than Java Language that can reduce the usage of resources and power consumption, and can accelerated response time. Shtinji Suematsu [2] introduced the idea of changing the predicted candidate word by estimating the context of users according to position information from Global Positioning System (GPS). The idea of predicting words as a context aware is acceptable. But, the context of predicted word is not only demand on location of users. It also depends on the mobile phone users typing usage pattern over time. Ye Kyaw Thu [6] proposed Myanmar language SMS text entry system for Multi-tap phones with the idea of consonant clustering prediction. Jianwei [4] presented hybrid Chinese input method for touch screen mobile phones that leverages hieroglyphic properties of Chinese characters to enable faster and easier input of Chinese character on mobile phone. Ahmet Cuneyd Tantug [1] used n-gram probabilistic and K best Viterbi decoding to generate a list of predictions for Multi-tap phones. Most of the prediction on Multi-tap phones used dictionary approach. To the best of the knowledge, prediction text entry system for touch screen mobile phone has still research work. The attempt of the proposed system is hybrid used of Position Aware Matching Model and Statistical Probabilistic (Bigram Model) to develop effective syllable prediction soft keyboard on touch screen mobile phone.

3. Problem Statement

There are many issues to the propos system. Firstly, according to the lasted version Android Software Development Kit (SDK 3. the True Type Font for Myanmar Language not embedded on Android OS. Thus, Unicc Rendering engine for Myanmar Language (a for Complex Text Language) is the difficulty the proposed system. Secondly, any dig format of lexicon and corpus to predict the usa of frequency table for Myanmar characters are not ready also. Thirdly, to give suggest word by word like Western language such as Latin IME, etc., white space between words is helpful. For phonetic scripts such as Myanmar Language, white space is not used between words or syllable but in well known phrase or part of speech (POS). To develop statistical prediction of candidate list, it is largely depends on previous word. If the words are segmented with white space, the previous word can easily be tokenized. For example, in Myanmar short senten သူငယ်ချင်း နေကောင်းရဲ့ လား။ (Hi friend, How are you.) white space is only used between phrase. It takes the difficulty to the proposed system to tokenize the previous Myanmar syllable.

4. Proposed System Design

The proposed syllable prediction IME proceeds by repeating the following three steps and the architecture of the proposed system is presented in Figure 1.

Step1: The user enters the character key to form one syllable by using IME.

Step2: In character level, Position Match engine combine the user current touched key with its corresponding vowel to form one syllable by using PAM Model. Position Match engine runs until the user assume to be one syllable by selecting the desired syllable from candidate list.

Step3: After the user chooses his desired syllable from the candidates list, Bi-gram engine predict the next syllable by ranking syllable in training corpus.

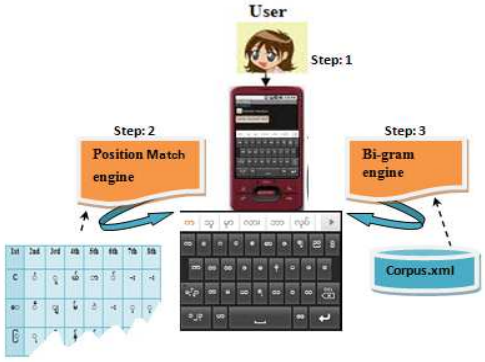

Figure 1. The Architecture of the Proposed System

The proposed method tries to find the intended syllable in two stages. In the first stages, it is need to predict the candidate syllable in character level. In Myanmar Language, to be one syllable E vowel [ေ], A vowel [ာ], AI vowel [ဲ] , Medial Y [ျ] , Medial R [ြ] ,Medial W [ွ] ,Medial H [ှ] , Asat [်] , Upper vowel [ိ ီ] , lower vowel [ု ူ] , Anusvara [ံ] , Lower Dot [့] , Visarga [း] that are written with a consonant. For example,

ကိုက် ; kite(bite) = က+ိ+ု+က+်

ခွေး ; kway(dog) = ခ+ေ+ွ+း

Because of the complex writing style of Myanmar text, typing all the consonants and its corresponding vowel to be one syllable is time consuming process. Thus, the proposed system targeted to predict syllable in character level firstly. After that next syllable prediction can save the Key Stroke in syllable level.

4.1. Position Aware Matching Model

To make prediction in character level, PAM model is used. According to the experiment, there are at most 8 positions in length to be one syllable in Myanmar Language as shown in Table 2. To avoid the memory usage and excessive processing load in mobile devices, instead of saving syllable by trees structure, the proposed system combine the consonant က,ခ,ဂ, etc. , its vowels ိ,ီ,ု,ူ, etc. , medial ျ,ြ, etc. and finals ယ်,င်,န့်,မယ်, etc. according to position information at runtime. Illegal syllable formations are discarded and the remaining syllables take the role of suggestion in candidate view according to the following Algorithm as stated in Figure 2.

Table 1. Myanmar Syllable Sample

Myanmar syllable sample	1st position	2nd position	3rd position	4th position	5th position	6th position	7th position	8th position	meaning
လာ	လ	ာ	-	-	-	-	-	-	come
သား	သ	ာ	း	-	-	-	-	-	son
များ	မ	ျ	ာ	း	-	-	-	-	many
လွယ်	လ	ွ	ယ	်	-	-	-	-	easy
ကောင်း	ေ	က	ာ	င	်	း	-	-	good
ကျောင်း	ေ	က	ျ	ာ	င	်	း	-	school
မြှောင့်	ေ	မြ	ှ	ာ	့	ာ	င	်	raise

Algorithm 1: Position Aware Matching (PAM)
Input: current_character,vowel_group,syllable_Dictionary
Output: candidate_ syllable_list
Begin
-check **current_character** position;
-load corresponding **vowel_group**;
-brute force match **current_character** with **vowel_group** according to position information;
If (check matched syllable is contained in **syllable_Dictionary**) **then**
-add matched syllable to **candidate_syllable_list**;
Else
-discard matched syllable;
End If
End

Figure 2. Position Aware Matching Algorithm

4.2. Statistical Language Models

After the user commit one syllable from candidate view, for syllable level prediction, statistical language model (bi-gram model) take the responsibility of the next syllable prediction. Statistical Language Models (SLMs) are originally developed for speech recognition. Later, they are applied intensively in natural language processing such as spelling checking, etc. In the proposed prediction, SLMs define probability distributions on syllable sequence.
Let S be a sequence with s syllables:

$$S = S_1^n = s_1 s_2 \dots s_n \quad (1)$$

By using a SLM, the probability of a sentence S can be computed with the following formula:

$$P(S) = P(s_1^n) = P(s_1)P(s_2|s_1) \dots P(s_n|s_{1\dots} s_{n-1}) \quad (2)$$

$$P(S) = \prod_{i=1}^{n} P(s_i \mid s_1^{i-1}) \quad (3)$$

According to Equation (3) the probability of any syllable sequence can be calculated by decomposition using the change rule, but due to sparseness, most term would be

0. Thus, n-gram approximations are used to reflect a Markov assumption that only the most recent n-1 tokens are relevant when predicting the next syllable:

The proposed next syllable prediction used one of the most frequently used language model in the text entry research (Bigram SLMs) as depicts in Equation (5).

For example, if the user enter သူ (သ+ူ) key sequence, the candidate syllable would be ငယ် rather than များ because $P(\text{ငယ်}/\text{သူ}) > P(\text{များ}/\text{သူ})$. After analyzing the entire candidate syllable, the selected candidate syllables are ranked according to probability aging. To get quick response time, the proposed system used priority queue rather than using conventional quick sort algorithm.

5. Experimental Result

The proposed system is developed with Java on Android platform (2.2 Froyo) and experimented with six users at different age level (10-20, 20-25, 25-30, 30-40, 40-50, Over 50). In choosing Bi-gram corpus, only a short dialogue sentences from well know novel, SMS log from University campus, interview sentences and comments on Unicode standard followed web site are used.

Before making analysis, each learner has given 5minutes demonstration times and 15 minutes practice time respectively and let to type their desire random sentences for 6 times. After the excessive user conduct, the recorded users typing speeds are calculated for evaluation process. The analysis of the proposed system over currently used Myanmar soft keyboard on Android (MyanDroid) with Equation (6) and Equation (7) show that the proposed system can enhance KSPC and SPM around twice as represented in Figure 3 and Figure 4.

#Character = Total no of Character
KS = Key Stroke
KSPC = Key Stroke per Character
SPM = Syllable per Minutes
CPS = Character per Syllable
TPC = Time per Character

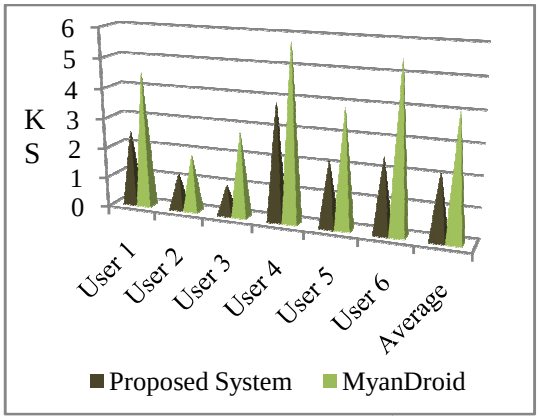

Figure 3. KSPC Comparison of the Proposed System and MyanDroid

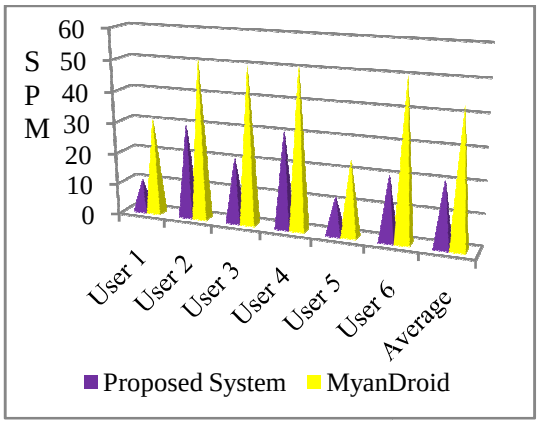

Figure 4. SPM Comparison of the Proposed System and MyanDroid

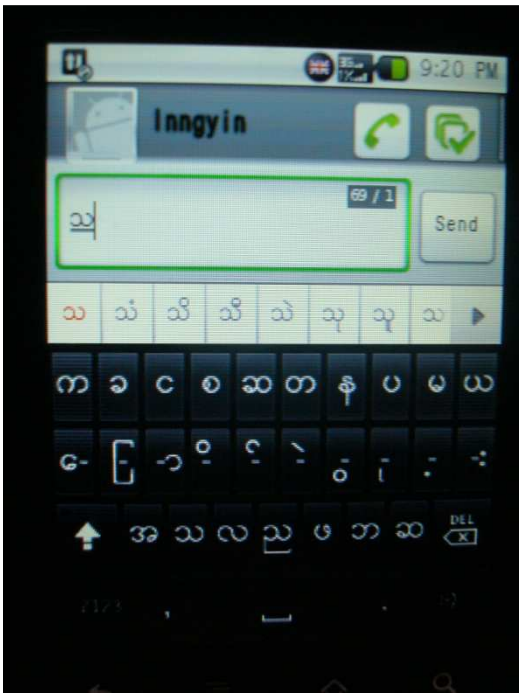

Figure 5. Character Level Prediction

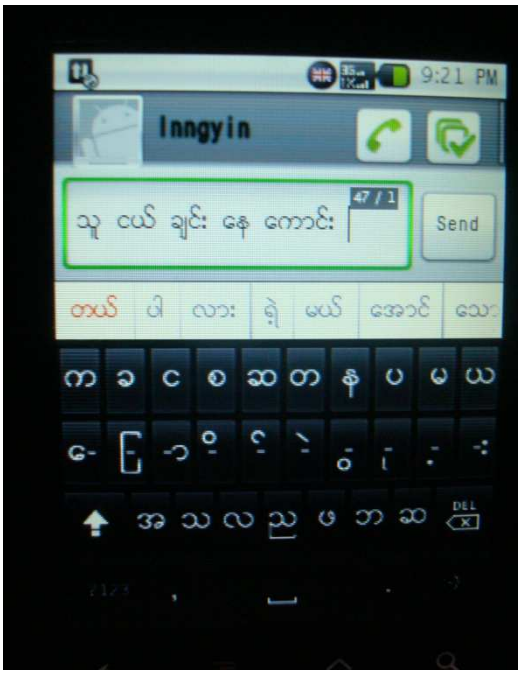

Figure 6. Syllable Level Prediction

6. Conclusion

In this paper, the proposed Myanmar syllable prediction text entry is evaluated with currently used without prediction input system on Android (MyanDroid) according to the evaluation metrics of KSPC and WPM. Moreover, the proposed system can be used not only in mobile devices but also can be used in guiding disable's text entry system with the increase in the speed of processors and the increase in storage capacity.

7. Limitation and Extension

The limitation of the proposed system is to use visual typing order and dummy white space is use between syllables. Moreover, some Pali characters cannot be typed because of without Unicode rendering engine on Android platform till now. Part of Speech (POS) completion and correction of Spelling will be extended to complete efficient Input Method. Moreover, to meet the lasted trend of Web 3.0 and to improve the efficiency of user more and more in future, some personalized prediction IME will be desirable.

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