

MyTap と M9 : 携帯電話における ミャンマー文字入力の既存 2 手法の比較

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今日、ミャンマーの携帯電話マーケットには、MyTap と M9 の 2 つのキーボード・レイアウトあるいは文字入力手法のみが存在している。本論は、この 2 手法に関し、ミャンマー文字の入力に必要なキーストローク、1 分間に入力可能な文字数 (CPM)、ユーザーによる評価の観点から比較するものである。研究の結果、両手法とも次に入力する文字によって子音・母音モードを切り替えることが分かった。M9 のキーボード・マッピングは興味深い、初心者ユーザーが習得するのは容易ではない。ユーザースタディの結果、(i-mode の場合) MyTap の CPM と M9 の CPM に大差はなく、分散分析の結果は($F_{1,4} = 0.144$, ns)であった。また、MyTap のキーボード・レイアウトは表示がややこしく、入力編集作業の妨げとなる。ユーザーの多くは上述の 2 手法のもつタイムアウト問題にわずらわしさを感じている。

MyTap and M9: Comparison of Two Existing Methods for Myanmar Mobile Phone Text Input

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Today, there are only two keypad layouts or text input methods in the Myanmar mobile phone market namely MyTap and M9. This paper reports a comparison of those two methods in terms of Keystrokes required to type a Myanmar character, Characters per Minute (CPM) and users' evaluation. What we have noticed from this study is that both methods are preparing the next text input step or changing consonant to and from vowel mode. Although M9 keypad mapping is interesting, it is not easy for first-time users to learn it. According to the current user study, CPM of MyTap is not statistically significant as the one of M9 (i-mode=on). The result of an analysis of variance (ANOVA) is ($F_{1,4} = 0.144$, ns). MyTap also has a complicated keypad layout displaying feature for typing and editing process. Most users feel uncomfortable with time out problem of those two methods.

1. Introduction

Today, mobile phone is popular and SMS is also available in Myanmar, however, text input method for Myanmar language in mobile phones is still a challenge research topic. There are only two keypad layouts or text input methods in the Myanmar mobile market, which are MyTap and M9. In this paper, we present a result of our comparison between them.

2. Myanmar Language (Burmese)

Myanmar language has been a major language of Myanmar (Burma) for over a millennium, and it is, at the same time, the official language there. It is a tonal and analytic language, which belongs to the Tibeto-Burman language family and derives from Sino-Tibetan. Myanmar alphabet adapted the Mon script in the 8th century. The language has various types of characters compared to English, i.e. consonants, medial consonants, dependent vowels, independent vowels, tones, punctuation marks and subscript characters or conjunction alphabet etc., and contains many Pali words especially in religious vocabulary such as praying [1, 2, 3]. Overall writing direction is from left to right, and the word order is SOV (Subject+Object+Verb). In a Myanmar sentence, spaces are used to mark phrases, not to divide words.

3. Keypad Layout and Text Entry Method for Myanmar

In this section, we present two keypad layouts of MyTap and M9 as well as their text entry methods for Myanmar. Although those two keypad layouts are designed on the 12-key mobile phone keypad, their keyboard mappings differ largely from each other (see Figure 1 and Figure 2) but have a common approach for text entry process.

3.1 MyTap

MyTap (Technomation Studios, Myanmar), is the Myanmar text input method run on MySM (Myanmar language Short Messaging System) software [4]. To our knowledge, it is the first text input method that came out as a product in 2006.

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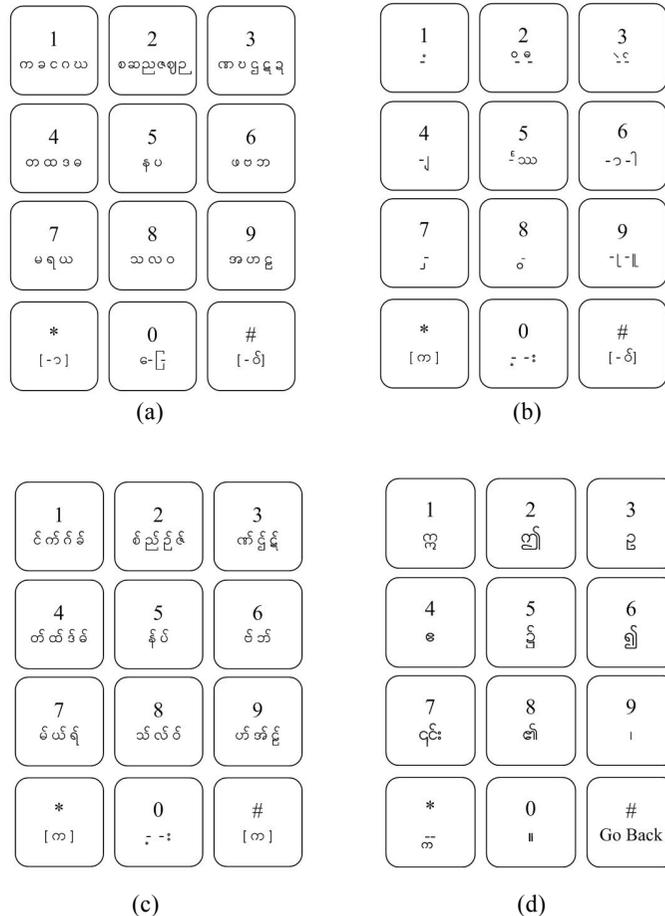


Figure 1. MyTap keypad layout
 (a) consonant mode (b) vowel mode
 (c) consonant character with Asat mode and (d) independent vowel mode

MyTap keyboard mapping basically has three layers (1) consonant character mapping (က mode), (2) vowel character mapping (ဝ mode) and (3) consonant character with Asat mapping (δ mode) (see Figure 1). If we count keyboard mapping for independent vowels as one, there exists four keypad layouts in total (see (d) of Figure 1). Consonant character mapping is

mainly to map the Myanmar consonants "က" (Ka) to "အ" (A) to key 1 to key 9, and "ေ" (E) vowel and "ြ" (Ra) Medial to key 0. It does not adopt alphabetical order of consonant (e.g. က, ခ, ဝ, ယ, ဝ) but use frequency order (e.g. က, ခ, ဝ, ဝ, ယ) (see (a) of Figure 1). Vowel character mapping is based on the writing position or combination of vowels with a consonant, e.g. upper vowels "း" (Anusvara), "ိ" (I), "ိ" (Ii), "ိ" (Ai) and "ိ" (Asat or killer) are mapped to key 1, key 2 and key 3 (upper row keys on a mobile phone keypad), and lower vowels or medials "်" (Ha), "်" (Wa), "်" (U) and "်" (Uu) are mapped to key 7, key 8 and key 9 (lower row keys). But character mapping to key 5 is not based on the writing position of vowels because "ိ" (kinzi) is always written on the upper part of a consonant. Consonant character with Asat mapping or (δ mode) is for typing the combination of Asat character with a consonant (e.g. န် = န + ဝ်). The keypad layout for Myanmar independent vowels such as "ဝ" (I), "ဝ" (Ii), "ဝ" (U) etc. and Myanmar punctuation symbols "၊" (little section) and "။" (section) can be seen in (d) of Figure 1.

MyTap is a phase predictive text input method, which does not predict Myanmar syllable, word or phrase. It predicts a next typing step or a change from one mode to another especially from vowel mode to consonant mode, and the keyboard layout always pops up. For example, after a vowel "း" (Visarga) is typed, the mode will automatically change to consonant mode. Typing step of MyTap is the same as handwriting order (e.g. left vowel + consonant) and not Unicode typing order (e.g. consonant + left vowel). In MyTap keypad layout, key "*" and "#" are used for changing from one mode to another, but the function varies depending on the active layer. For example, key "*" is used to change exiting mode to consonant mode (က mode), vowel mode (ဝ mode) and Paiksint or subscript mode (ဝ် mode). Myanmar numbers can be typed with "Input Number" menu, and English letters can be typed with "Input English" menu. Space can be placed by pressing key 0 longer, and enter can be typed by pressing key "#". The following is the typing steps of "နေကောင်းလား။" (How are you?) with MyTap text entry method, which requires 18 keystrokes for 12 characters.

Table 1. Typing steps of Myanmar phrase "နေကောင်းလား။" (How are you?) with MyTap

ေ	န	ေ	က	mode	း	mode	ြ	း	လ	mode	း	mode	။
0	5	0	1	*	6	#	1	00	88	*	6	00	* 0

3.2 M9

M9 (Myanmar9) is the Myanmar text input method (R & S Software, Myanmar), which is distributed with SM3 (Simple Myanmar Message) software. As far as we are concerned, it is the second text input method that came out as a product in 2007. Its keypad layout is based on the glyph or shape of Myanmar characters as follows:

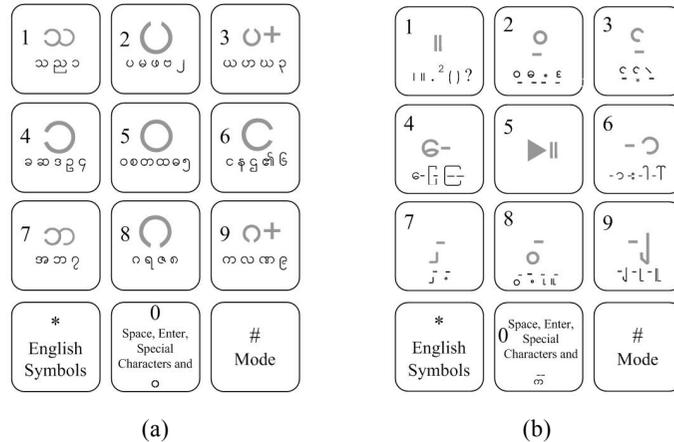


Figure 2. M9 keypad Layout
 (a) consonant mode (b) vowel mode

Most of the Myanmar character glyphs or shapes consist of various combinations of circle or Landolt C structure such as consonants "က" (Ka), "ခ" (Kha), "ဂ" (Ga), "ဃ" (Gha) and "င" (Nga), vowels "ာ" (Aa), "ိ" (Visarga), "ု" (U) and "ူ" (Uu), and numbers "၁" (1), "၃" (3), "၄" (4), "၈" (8) and "၀" (0) [1, 5]. And thus, they can be grouped as circle shaped characters (e.g. "က", "ခ" and "က"), left gap shaped characters (e.g. "ခ", "ဆ" and "ဒ"), right gap shaped characters (e.g. "င", "န" and "ဋ"), bottom gap shaped characters (e.g. "ဂ", "ရ" and "ဇ") and up gap shaped characters (e.g. "က", "ဖ" and "ဇ"). We have found that M9 keypad layout for Myanmar consonants are mapped based on the glyph or shape (see (a) of Figure 2), and its vowel mapping is based on the writing position or combination of vowels with a consonant (see (b) of Figure 2). English symbols such as "!", ":", ";", ",", "?", "(" and ")" are assigned to key "*", and mode can be changed by pressing button "#".

M9 is also a phase predictive text input method like MyTap. The main difference is that

users can turn on or off this feature (i.e. i-mode=on or i-mode=off option in the M9 setting). The system predicts a next possible phase with "i-mode=on" (i-mode is assumed as interactive or intelligent mode) setting, and it does not work with "i-mode=off" setting. Users can control the mode manually with "i-mode=off" setting (e.g switching from consonant to vowel mode). There are five modes in total, which are "က" (Myanmar consonant), "ာ, ဘ, ဝ" (Myanmar vowel), "ABC" (English capital letter), "abc" (English small letter) and "123" (English number) mode. Key 5 works as "go back button" to Myanmar consonant mode while vowel mode is active. button Myanmar numbers 0 to 9 can be typed by pressing keys 0 to 9 longer (e.g. Myanmar number 6 "၆" can be typed by pressing "key 6" longer). Paiksint or subscript characters can be typed by pressing key 0 while vowel mode is active.

"I-mode=on" setting works as Unicode typing order (e.g. consonant + left vowel) and timing on, and "i-mode=off" setting is handwriting order (e.g. left vowel + consonant) and timing off. The following is the typing steps of "နေကောင်းလား။" (How are you?) with M9 text entry method, which requires 18 keystrokes for 12 characters. One of our findings here is that it is difficult for novice users to type with 18 keystrokes due to time limitation.

Table 2. Typing steps of Myanmar phrase "နေကောင်းလား။" (How are you?) with M9 (i-mode = on)

န	ေ	က	ေ	ာ	mode	်	း	လ	ာ	း	။
66	4	9	4	6	33	6	66	99	6	66	11

4. Methodology

Here, we present the information of participants, apparatus and procedures for text input user study with MyTap and M9 text input methods.

4.1 Participants

5 volunteer participants (3 males and 2 females) were recruited in the Yangon city, Myanmar. Participants ranged from 24 to 34 years (*mean* = 29.8, *sd* = 3.4). One of them was familiar with mobile phone and had prior experiences of Myanmar text typing with MyTap and M9, and for the rest of them, it was the first time to type Myanmar text with mobile phone.

4.2 Apparatus

We installed MySM Release 1.9.2 (MyTap version 1.5) and SM3 (free version) to a Nokia

mobile phone. We used a Nokia mobile phone (Model: 3110c) for user study on MyTap and M9 text input methods. We also used Nokia mobile phone emulator of "Series 40 6th Edition SDK" for counting required keystrokes to type a Myanmar character [6]. Myanmar text for user study consisted of 107 characters including 41 consonants, 52 vowels, 7 numbers, 6 symbols and 1 space, as shown below.

သူငယ်ချင်း၊	(Hi, friend!)
မတွေ့ရတာကြာပြီနော်။	(Long time no see.)
နေကောင်းရဲ့လား။	(How are you?)
ငါ့ဖုန်းနံပါတ်အသစ်က ၅၀၀၇၄၅၉။	(My new phone number is 5007459.)
အားတဲ့အခါဖုန်းပြန်ဆက်ကွာ။	(Call me back when you have time.)
ဒါပဲနော်။	(Bye for now.)

4.3 Procedures

The procedures for user study are (1) explaining the keypad layout and text input method of MyTap and M9, (2) making demonstration of typing Myanmar text with Nokia mobile phone, (3) allowing practice time to finish each model, (4) recording the participants' typing speed of short Myanmar message (6 sentences) for 10 times (including error correction time) (Note: M9 setting is imode=on and i-speed=6x) and (5) discussing with them and getting their evaluation.

5. Result and Discussion

5.1 Speed (Characters per Minute)

Figure 3 shows the users' typing speed to finish short Myanmar message (see section 4.2) with MyTap and M9. The speed was calculated based on the *Characters per Minute (CPM)*, which is generally calculated as [characters per second] x 60. We evaluated typing speed with CPM instead of *Words per Minute (WPM)* [7]. This is because there is no standard definition for a word in Myanmar like in English (i.e. common definition of a word = 5 characters, including spaces) (Yamada, 1980). In order to know whether there exists significant difference between MyTap and M9, we used an analysis of variance (ANOVA). The result is not statistically significant ($F_{1,4} = 0.144$, ns) (see Figure 3).

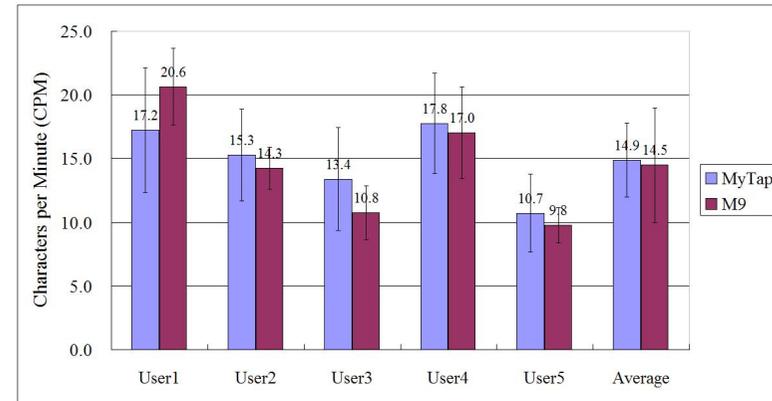


Figure 3. Characters per Minute (CPM) of 5 users with MyTap and M9

5.2 Keystrokes

Keystrokes per Character (KSPC) is the number of keystrokes or stylus strokes required, on average, to generate each character of text using a given interaction technique in a given language [7, 8]. Here, however, we didn't use KSPC formula but counted keystrokes manually to make comparison of keystroke requirements only (i.e. typing error and text editing process is excluded) to finish Myanmar text. We counted required keystrokes to type "frequently used Myanmar syllables" (see Table 3), "Myanmar words formed by two identical syllables" (see Table 4), "Pali and special words" (see Table 5) and "Myanmar text for user study" (see section 4.2).

When we count keystrokes, we need to count twice for MyTap and four times for M9. This is because the number of keystrokes depends on combination methods of consonant and Asat (e.g. "consonant + Asat" method or "(δ) + consonant" method), "i-mode=on" (i.e. Unicode writing order and mode is changed automatically by timing) or "i-mode=off" (i.e. handwriting order and mode is not controlled by timing). And thus, we counted keystrokes for "consonant + Asat" and "(δ) + consonant" methods for MyTap and "i-mode=off", "i-mode=on" and "consonant + Asat", "i-mode=on" and "(*) + consonant" methods and "in case of time out". The result clearly showed that M9 required higher number of keystrokes than MyTap in the typing process of Myanmar text (see Table 3, Table 4 and Table5). From the user study, we have noticed that all of the participants used "consonant + Asat" method mostly, and "(δ) + consonant" and "(*) + consonant" methods sometimes.

Table 3. Keystroke comparison for frequently used Myanmar syllables

No.	Frequently Used Myanmar Syllables	MyTap		M9			Time Out
		C + Asat	(၎) + C	i-mode (off)	i-mode (on) C + Asat	8 mode (on) (* ^c) + C	
1	အဲ	3	3	4	4	4	N/A
2	ကို	4	4	6	5	5	6
3	သည့်	7	4	5	5	5	N/A
4	တယ်	7	4	6	6	6	N/A
5	နေ	2	2	5	3	3	N/A
6	ပါ	4	4	5	4	4	N/A
7	တွေ	4	4	8	5	5	6
8	မြစ်	7	5	11	8	9	N/A
9	ဆို	5	5	7	6	6	7
10	မှာ	4	4	5	4	4	5
11	တော့	5	5	10	7	7	8 or 9
12	တဲ့	4	4	8	8	8	9
13	တာ	3	3	5	4	4	N/A
14	လူ	5	5	7	6	6	N/A
15	များ	6	6	7	6	6	7 or 8
Total		70	62	99	81	82	

Many Myanmar words and names are formed by repeating the same character or syllable, e.g. common names "အောင်အောင်" (Aung Aung), "မြင့်မြင့်" (Myint Myint), "ကိုကို" (Ko Ko) etc., and words "ပါပါ" (dad), "မေမေ" (mom) etc. We have chosen 10 Myanmar common words for counting the number of keystrokes required to type with MyTap and M9 (see Table 4).

Table 4. Keystroke comparison for Myanmar words formed by two identical syllables

No.	Myanmar Words Formed by Two identical Syllables	MyTap		M9			Time Out
		C + Asat	(၎) + C	i-mode (off)	i-mode (on) C + Asat	i-mode (on) (* ^c) + C	
1	မင်းမင်း	18	10	15	14	14	15 or 16
2	ကိုကို	11	11	13	10	10	11 or 12
3	နိုင်နိုင်	22	12	23	16	18	18 or 19 or 20
4	ပါပါ	11	11	11	8	8	N/A
5	မေမေ	4	4	10	6	6	N/A
6	ဖေဖေ	4	4	12	8	8	N/A
7	ဘုန်းဘုန်း	24	18	27	20	22	23 or 24
8	အေးအေး	10	10	13	8	8	9 or 10
9	မြင့်မြင့်	20	12	21	16	18	17 or 18 or 21 or 22
10	အောင်အောင်	22	14	19	10	12	11 or 12 or 15 or 16
Total		146	106	164	116	124	

Myanmar has borrowed words from Pali and Sanskrit since the advent of contact with those languages. Some words have been borrowed in toto (e.g. "ဒါန", "သီလ", "အနိစ္စ", "ဒုက္ခ", "အနတ္တ"), and others have been adapted to suit Myanmar tongue and ear (e.g. "စိတ္တ" to "စိတ်", "ဓာတု" to "ဓတ်", "စရိတ" to "စရိတ်", "မန္တိ" to "မန္တိန်") [9]. Since many Pali words use subscript consonants, we made keystroke comparison for Pali words such as "တက္ကသိုလ်" (university), "သစ္စာ" (truth, veracity), "မေတ္တာ" (kindness, affection) and "နိဗ္ဗာန်" (Nirvana, heaven) with MyTap and M9 (see Table 5).

Table 5. Keystroke comparison for Pali or special words

No.	Myanmar Words (Pali or Special Words)	MyTap		M9			Time Out
		C + Asat	(δ) + C	i-mode (off)	i-mode (on) C + Asat	i-mode (on) (* ^c) + C	
1	တက္ကသိုလ်	15	12	22	18	19	19 or 21
2	မန္တလေး	11	11	19	18	18	18
3	ယောက်ျား	15	14	14	9	10	11 or 12 or 13 or 14 or 15
4	ကုဏ္ဍိ	11	11	19	16	16	17
5	မင်္ဂလာ	11	11	15	13	13	N/A
6	သစ္စာ	7	7	10	10	10	11
7	မေတ္တာ	8	8	17	15	15	15
8	ဥက္ကဋ္ဌ	9	9	15	14	14	N/A
9	ဧရာဝတီ	14	14	20	19	19	N/A
10	နိဗ္ဗာန်	17	14	22	17	18	18 and 20
Total		118	111	173	149	152	

Table 6. Keystroke comparison Myanmar text for user study

No.	Myanmar Text for User Study	MyTap		M9		
		C + Asat	(δ) + C	i-mode (off)	i-mode (on) C + Asat	i-mode (on) (* ^c) + C
1	သူငယ်ချင်း။	29	21	23	16	17
2	မတွေ့ရတာကြာပြီနော်။	34	34	43	33	33
3	နေကောင်းရဲ့လား။	28	23	33	23	24
4	ငါ့ဖုန်းနံပါတ်အသစ်က ၅၀၀၇၅၅၉။	51	43	61	48	51
5	အားတဲ့အခါဖုန်းပြန်ဆက်ကွာ။	45	39	59	45	47
6	ဒါပဲနော်။	18	18	23	17	17
Total		205	178	242	182	189
Total (including Enter key)		210	183	252	192	199

5.3 Questionnaire for Participants

A post-test questionnaire was completed by each participant. In it, MyTap was rated as easier to learn (2:3), quicker (2:3) and less typing mistake (2:3). As for the M9, it was rated as easier to learn (2:3), quicker (3:2) and less typing mistake (1:4).

We also requested for their comments or suggestions on MyTap and M9, and received the followings:

- Prefer MyTap because it is displaying keypad layout
- Both methods are annoying with timing
- M9 keypad layout is creative idea but difficult to memorize
- Prefer M9 with "i-mode=off" setting
- Why consonants are sorted by usage frequency order? Prefer alphabetical order and it is the best for the native people
- Both of the keypad layout are difficult to memorize
- Traditional handwriting order is better than Unicode typing order

5.4 Discussion

In the user study, we used "i-mode=on" setting for M9 text input system. One reason for this is that MyTap changes mode automatically from vowel mode to consonant mode and it has no timing off function, and another reason is that we wanted to prepare similar platform for comparison. From the user study results as well as users' comments and suggestions, we have found that almost all of the users faced with timing problem. The number of required keystrokes can be increased because of time out when user is searching and typing two consonants or more than one vowel continuously. Typing process of M9 with "i-mode=off" is better than that of M9 with "i-mode=on" for the users. On the other hand, "imode=off" setting requires the highest number of keystrokes than other typing methods or options (see Table 3, Table 4, Table 5 and Table 6). MyTap keypad layout makes it easier to find desired consonants than M9, because M9 keypad layout is based on the glyph or shape of the consonant, which is difficult to memorize for first-time users. We assume that Myanmar consonants keypad layout by alphabetical order is suitable for native users. MyTap has an annoying keypad layout displaying feature for them, because it covers a text editing screen and therefore users cannot see the typing text (see Figure 4). Another user interface problem of MyTap is that users need to type number in English first and then convert it to Myanmar number. What MyTap and M9 have in common is that they try to predict next typing steps. For the most participants, typing speed or CPM of MyTap was slightly higher than that of M9 (i-mode =on), but the result of an analysis of variance (ANOVA) is not statistically significant ($F_{1,4} = 0.144$, ns).

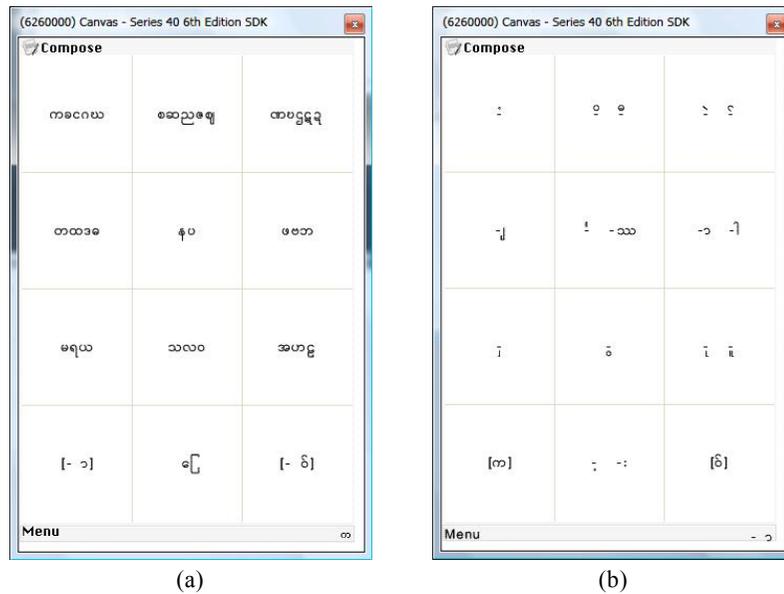


Figure 4. Nokia mobile phone emulator screen of MyTap
(a) consonant mode (b) vowel mode

6. Conclusion

Two methods for Myanmar text entry on mobile devices namely MyTap and M9 were evaluated. This research is in progress, and we have just reported the results of our current analysis in terms of number of keystrokes, CPM and feedbacks from users. From this study, we have found that both MyTap and M9 predict or prepare users' next typing step. Although M9 keypad mapping is interesting, it is difficult for first-time users to memorize. On the other hand, CPM of MyTap is slightly higher than that of M9 (i-mode=on) (14.9 CPM:14.5 CPM), but MyTap has a complicated keypad layout displaying feature for typing and text editing process. It was also found that most users feel uncomfortable with time out problem. We plan to make follow-up analysis in detail and propose positional prediction text input interface for mobile phone in the near future.

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