This dissertation presents studies on input interface of Asian characters based on common syllabic writing systems. Keyboard mapping, gesture text input and predictive text input are considered for designing text input interfaces. Positional Mapping, Positional Gesture and Positional Prediction are the three concepts discussed in this dissertation.

Positional Mapping (PM) is a concept of keyboard or keypad mapping for mobile devices based on characters writing position of Asian syllabic languages. Its concept is dividing a mobile phone keypad into three levels, e.g. 1, 2 and 3 keys are upper, 4, 5 and 6 keys are normal or middle and 7, 8 and 9 keys are lower. In the normal level, 4 key is deemed as a front part (Left), 5 key as a central part and 6 key as a rear part (Right).

Positional Gesture (PG) is a concept of gesture text input for mobile devices based on characters writing position of Asian syllabic languages. Its concept is totally based on four simple gesture commands, which are "Left", "Right", "Up" and "Down." Left gesture command" is for left characters or symbols, "Right gesture command" is for right characters or symbols, "Up gesture command" is for upper characters or symbols and "Down gesture command" is for lower characters or symbols.

Positional Prediction (PP) is a concept of predicting possible combinations of vowels with a consonant or a syllable based on the positional information (i.e. Left, Right, Upper and Lower) of vowels, medials or consonant signs etc.

As part of the ongoing evaluation of PM, PG and PP, various text input prototypes were developed. An emphasis was placed on users' typing speed, error rate and feedbacks in user study in order to recognize the feasibility and user-friendliness. PM and PG prototypes were developed for Myanmar (Burmese), Bengali and Khmer, and PP prototypes were developed for Myanmar, Khmer, Nepali and Thai respectively. These three approaches will contribute to find out common and user-friendly text input interfaces of Asian syllabic languages especially for mobile computing.

Dissertation Organization

Chapter 1 introduces the concept of Positional Mapping (PM). This concept uses keyboard or keypad mapping based on the characters writing position. Developed PM prototypes for a mobile phone, a numeric keypad, a PDA, the Ergodex DX1, a game pad and an electronic whiteboard are described in detail. Results of user studies prove user-friendliness and applicability of PM for Asian syllabic languages.

Chapter 2 describes background work that relates to this research in general, such as keyboard mappings and text input methods of several Asian syllabic languages for both a PC and mobile devices. A formal evaluation of text entry techniques is also mentioned briefly.

Chapter 3 introduces the concept of Positional Mapping (PM). This concept uses keyboard or keypad mapping based on the characters writing position. Developed PM prototypes for a mobile phone, a numeric keypad, a PDA, the Ergodex DX1, a game pad and an electronic whiteboard are described in detail. Results of user studies prove user-friendliness and applicability of PM for Asian syllabic languages.

Chapter 4 presents comparison results of the existing QWERTY based software keyboard and the software keyboard version of PM. This chapter clearly shows users' feedbacks on the developed Khmer and Bengali prototypes.

Chapter 5 presents comparison results of the PM software keyboard layout with two other possible keyboard layouts. Although there was no significant difference in text entry speed, Characters per Minute (CPM) of PM was the highest. Moreover, users rated the typing layout of PM the easiest.

Chapter 6 introduces the concept of Positional Gesture (PG). This concept uses left, right, up, down and center gestures or strokes commands for text input in Asian syllabic languages. Developed prototypes for Myanmar, Khmer and Bengali languages are described in detail. The user study results prove user-friendliness and applicability of PG for Asian syllabic languages.

Chapter 7 introduces the concept of Positional Prediction (PP). This concept uses four directional arrow keys, i.e., left, right, up and down arrow keys, for predicting possible combinations of consonant and vowels. Developed original PP prototypes for Myanmar and Khmer are described in detail. The user study results prove user-friendliness and applicability of PP for Asian syllabic languages.

Chapter 8 introduces how PP text input concept can be extended for small mobile devices. This chapter proposes new text input interface Positional Prediction Clickwheel (PP_Clickwheel) for mobile devices using clickwheel like the Apple iPod. Typing speed of novice users with PP_Clickwheel prototype was acceptable and positive feedbacks...
were received from them.

Chapter 9 begins with an introduction to the writing system and existing Romanization methods of Myanmar language, and then, a detailed explanation of Romanized handwriting text input interface is followed by a report of the user study results with my developed prototype. Finally, a discussion on my findings and suggestion for further text input interface research are made.

Chapter 10 presents font development, Direct Keyboard Mapping (DKM) and Romanized Positional Prediction (RomanPP_Fingerspelling) keyboard prototype for Myanmar language fingerspelling characters. Moreover, usability of my approach is discussed based on the user study results with the current fingerspelling software keyboard prototype.

Chapter 11 presents analysis results of Nepali and Thai syllables or vowels combinations with a consonant. There is also a discussion on why an analysis was made of possible combinations of vowels and a consonant, their patterns and maximum length in the current Nepali and Thai languages.

Chapter 12 introduces grapheme cluster segmentation tools developed for Myanmar language. Distributions of PP patterns of Myanmar and Khmer languages are described. Example usages of this tool for statistical analysis on distributions of Myanmar characters are presented in detail, and tool development for Khmer language is also introduced.

Chapter 13 concludes with prototypes design, major empirical results, a list of contributions, future work and closing remarks.