A Study on Improving User Input based on Pressure Sensitivity of Smartphone

Junho Ko\textsuperscript{1}, Yoon Sang Kim\textsuperscript{1}

\textsuperscript{1}Department of Computer Science and Engineering, Korea University of Technology and Education, Cheonan, Korea
yoonsang@koreatech.ac.kr

Abstract. This paper introduces a pressure-sensitive text input system that provides an easier and faster method for entering Hangeul in the rapidly expanding smartphone environment. In order to evaluate the effectiveness of the proposed system, a pressure-sensitive text input system is implemented, and Hangeul input experiments are conducted on mobile phones from two largest manufacturers in Korea (Samsung and LG). Whereas conventional Hangeul input methods used in Samsung and LG mobile phones require multiple touches for entering characters such as double consonants and diphthongs, the pressure-sensitive text input method allows the user to enter them with a single touch.

Keywords: pressure sensitivity, pressure sensing, text input, smartphone

1 Introduction

With the rapid dissemination of smartphones, extensive research is being conducted on touchscreen-based text input methods [1-8]. In addition to touch inputs, a touchscreen provides flexible user interface applications, such as continuous gesture inputs, and a number of input methods have been proposed. These input methods can be categorized into handwriting recognition, gesture-based text input, and soft keyboard-based text input.

Handwriting recognition uses conventional pattern recognition algorithms to recognize handwriting, and poses two major problems. First is identifying and associating significant groups among the continuous point inputs from the recognizer, and second is recognizing specific characters using the identified groups. To resolve these issues, several methods have been proposed, including Unistrokes [2], Graffiti [3], MDTIM (minimal device-independent text-input method) [4], and EdgeWrite [5]. However, there are limitations in terms of input speed because several strokes are required to constitute a single character.

Gesture-based text input allows the user to freely input characters without being confined to a structure, and proposed methods include Cirrin [6], Quikwriting [7], T-Cube [8], and Swype [9]. A major drawback of gesture-based text input is that characters must be input with reference to the key layout on the screen, and the user must always focus on the input character, making it difficult to get accustomed to the input mechanism.
Also referred to as virtual keyboard-based text input, soft keyboard-based text input allows the user to type characters by touching parts of a virtual keyboard presented on the screen. Because most users are familiar with the QWERTY system used in desktop computers, popular smartphones such as Galaxy S and iPhone have implemented the QWERTY system on the touchscreen for the soft keyboard input system [10].

Although a number of studies are being conducted on inputting characters for touchscreen-based smartphones, most of today’s smartphones have adopted input methods used in traditional feature phones. However, conventional text input methods cause frequent typing errors due to the small button areas in the touchscreen-based smartphone environment. Furthermore, the input error rate drastically increases when the user is trying to type characters while moving because unlike feature phones, there is no physical sense of pressing buttons in smartphones.

This paper introduces a study that involves using pressure sensitivity for improving user experience in the Hangeul input environment for smartphones. Hangeul input experiments are conducted to examine how pressure-sensitivity affects inputting Hangeul into smartphones: a simple text input system based on pressure sensitivity is implemented and applied to Hangeul input systems used by two major mobile phone manufacturers in Korea (Samsung and LG) to evaluate the benefits of the proposed system. Experimental results are given and discussed.

2 Proposed Pressure sensing-based Hangeul Input Method

This section describes the pressure-sensitive keypad text input system implemented to use pressure for inputting characters.

Whereas conventional text input methods use coordinate values and touch duration detected on the touch panel as input data, the method proposed in this paper also uses pressure value as additional input data.

The block diagram of the implemented system is shown in Figure 1.

![Fig. 1. Block diagram of proposed pressure-sensitive text input keypad system.](image)
3 Experiments

This section examines how pressure-sensitivity affects inputting Hangeul into smartphones. To do so, a simple pressure-sensitive keypad input system is implemented and applied to Hangeul input systems used by two major mobile phone manufacturers in Korea (Samsung and LG) for user experience evaluation.

Experiments involved participants performing identical tasks using 1) conventional text input system without using pressure (conventional methods); and 2) applying pressure-sensitivity to the conventional text input systems (proposed methods). Evaluations were made for the time required, number of touches required, and number of errors.

The experimental environment for user experience evaluation is shown in Figure 2.

![Figure 2](image-url)

**Fig. 2.** User experience evaluation test using proposed pressure-sensitive keypad system: (a) Hangeul input environment that incorporates the proposed pressure-sensitive keypad system for Samsung mobile phones (Cheonjiin), (b) Hangeul input environment that incorporates the proposed pressure-sensitive keypad system for LG mobile phones (Naratgeul).

A sentence (National Anthem of Korea, 52 characters) was input using four text input methods (Cheonjiin, Naratgeul, Cheonjiin with proposed system, and Naratgeul with proposed system), and the numbers of touches required were recorded.

In the experiment, numbers of touches were compared for inputting a sentence (National Anthem of Korea, consisting of 52 characters). Experimental results
indicate that using pressure sensitivity to input a sentence decreased the number of touches required by 13% (Samsung mobile phones - Cheonjiin) and 7% (LG mobile phones - Naratgeul).

4 Conclusion

This paper proposed a pressure-sensitive text input system that provides an easier and faster method for entering Hangeul in the rapidly expanding smartphone environment. In order to evaluate the effectiveness of the proposed system, a pressure-sensitive text input system was implemented, and Hangeul input experiments were conducted on mobile phones from two largest manufacturers in Korea (Samsung and LG). Whereas conventional Hangeul input methods used in Samsung and LG mobile phones require multiple touches for entering characters such as double consonants and diphthongs, the pressure-sensitive text input method allows the user to enter them with a single touch. In the case of entering a complete sentence, the number of touches required decreased by about 10%, demonstrating that the pressure-sensitive text input method is more efficient than conventional methods.

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References