

# Study of Input Modalities on PDA's

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## Abstract

PDA's can be useful for point of care medical applications because of their portability and wireless connectivity capability. However, their small screen and input modalities affect the performance and user satisfaction.

In this article we present a study in which six methods for numeric and textual data input on a PDA are compared. The results indicate that the voice input modality was preferred for textual input and a custom made soft keyboard for numeric input.

## 1. Introduction

Personal digital assistants (PDA's) can be very useful, especially in the medical area. Because of their portability they can be used by medical professionals to enter and view patient information on the patient's record at the bed side. However, portability comes with a price. Their small screen reduces the area available for entering and viewing information. In addition their input modalities reduce the users' performance entering text. Thus, there is a need for improving the input modalities and the interfaces to accelerate data input.

Some studies show that PDA technology has to be improved in various areas; especially, in the time factor. A study [Jao03] was made to investigate why a digital resident diagnosis log on PDA was poorly accepted. The authors concluded that one of the reasons was the slowness of the devices. In other study [Young01] an evaluation was made by nurses on a hand-held for data entry on nursing record simulations. Nurses considered that the pen-based interface was less desirable for entering data than the keyboard interface. They thought that the data was less accurate and the data entry process was difficult.

This research compares six methods for numeric and textual data entry on a Sony Clie PEG-NZ90 running on PalmOS5. This project is based on a previous

work on a PDA prototype for accessing electronic patient record systems [Rodríguez03]. The original interfaces were designed by Yajaira Soler for a PocketPC PDA [Soler03]. We made some modifications on those interfaces and developed a program for a PDA with PalmOS to study some input methods.

## 2. Usability Tests

Five usability tests were performed involving the input methods that will be described in the next session. The interface for entering the vital signs from the Nurses/Medical Clerk Module on the PDA was used for the tests. A prototype of this interface was developed for each input method.

Before each test the user receives an orientation about the purpose of the test and a brief introduction of what the test is about, and how to use a PDA (if it is necessary). After the orientation the participants were asked to complete tasks that require entering a set of vital signs. When the test is finished the participant is asked to complete a user satisfaction questionnaire.

The following information is collected in each test:

- **Time to complete a task** – from the moment the user place de stylus on the screen until he/she completes the tasks.
- **Preference** – The users will express their preference with each input method using a scale from 1 to 7 with 1 being poor, and 7 being excellent.
- **Comments** – The participant were encouraged to comment on any particular thing about the input methods and the user interfaces.

### 3.1 First Usability Test

For the first usability test we compared three user interfaces for the up/down custom made method.

This method consists of buttons to increment or decrement each digit until the desired number is reached (see figure 1). A digit is incremented by pointing at the symbol above it. Similarly a number is decremented by pointing at the symbol below it. These were identical except for the symbol on the button (see figures 1, 2 and 3).

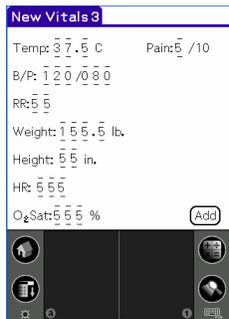


Figure 1: Interface A



Figure 2: Interface B

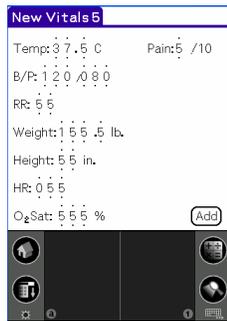


Figure 3: Interface C

Eighteen students from the Electrical and Computer Engineering Department at the University of Puerto Rico at Mayagüez participated in the test.

### 3.1.2 Results

In terms of user satisfaction interface B was the preferred interface with 44% of the participants selecting it. Interface A was the second selection and interface C was the third.

In terms of completion time the participants were able to complete the tasks significantly faster with interface B than with the other two. The participants took about the same time in completing the tasks with the other two interfaces.

Since interface B was the most preferred interface and also was the one that took the participants less time to complete the tasks the other two interfaces were discarded. Interface B was then used for the second usability test.

## 3.2 Second Usability Test

For the second usability test we used Interface B of the first test (the preferred interface). Two versions of that interface were developed; one with default values (see figure 4) and the other with values of zero (see figure 5). For this test 16 students from the Nursing Department of the University of Puerto Rico at Mayagüez participated.



Figure 4: Interface A



Figure 5: Interface B

### 3.2.1 Results

From the results we discovered that the faster and preferred interface was Interface A. Subjects said that it was easier to input the numbers on the Interface A because they had to tap less on the buttons to enter the desired digit.

## 3.3 Third Usability Test

For the third test, the Interface A (see Figure 4) from the second test was compared with the interface that features the custom made numeric soft-keyboard (see Figure 6) This method is an on-screen numeric soft-keyboard to input data on each blank field on the interface (see figure 6). The numbers are entered by pointing at the corresponding numeric symbols. This test was done with 16 nursing students.



Figure 6: Interface B

### 3.3.1 Results

In terms of user satisfaction the preferred interface was Interface B. In terms of completion time Interface B was also better than interface A.

### 3.4 Fourth Usability Test

The fourth usability test consisted of two parts; the first was the textual part and the other the numerical part. This test was done with 28 students from the nursing department.

#### 3.4.1 Textual input

In the textual part the experimented methods were the Palm's software keyboard (see Figure 7) and the device's hardware keyboard (see Figure 8).



Figure 7: Interface A



Figure 8: Interface B

#### 3.4.1.1 Results

The results were that more people preferred the hardware keyboard than the software keyboard (see Chart 1); also, the hardware keyboard method resulted faster (see Chart 2). The users explained that they felt more familiarized with the hardware keyboard because it's similar to the regular computer keyboard. Also, they can use their both hands to press the buttons, this way the data entry process resulted faster.

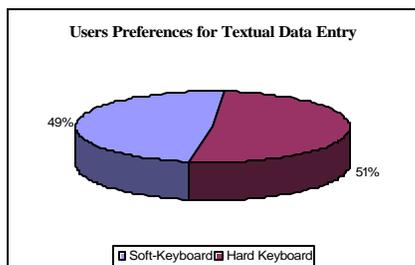


Chart 1

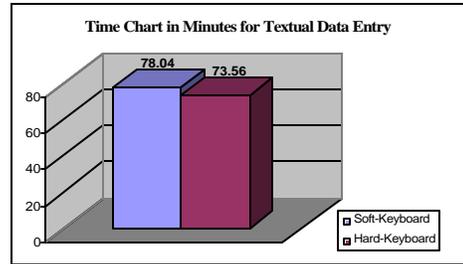


Chart 2

#### 3.4.2 Numerical input

In the numerical experiment the input methods were the Palm's software keyboard (see Figure 7) and the custom made numeric soft-keyboard (see Figure 6).

##### 3.4.2.1 Results

The results showed that the preferred and faster interface was the custom made numeric soft-keyboard, (see Chart 3 and Chart 4). Some users explained that they preferred this interface because it has the buttons closer to the entry fields than the other; this resulted in less navigation to enter the data.

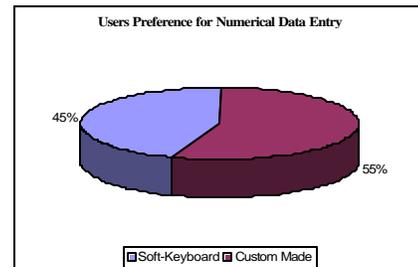


Chart 3

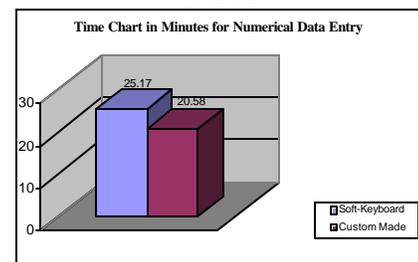


Chart 4

### 3.5 Fifth Usability Test

For the fifth usability test we tested the device's hardware keyboard (see Figure 8) vs. the device's voice recorder for textual data entry. This test was conducted with 26 nursing students in the nursing department. Like in the previous tests, the majority of the subjects didn't have any experience with PDA's before this test.

### 3.5.1 Results

We found that most people preferred the voice recorder (see chart 5). Also, the results showed that the recorder was 92% faster than the hardware keyboard (see chart 6). Most users said the method was easy to use and fast. Although, some of them showed some concern because of the HIPAA privacy law; they felt that the method was not private enough and this can bring some legal issues. But they felt that the method was useful especially for recollecting data in a minimum time.

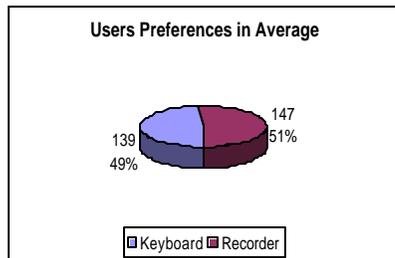


Chart 5

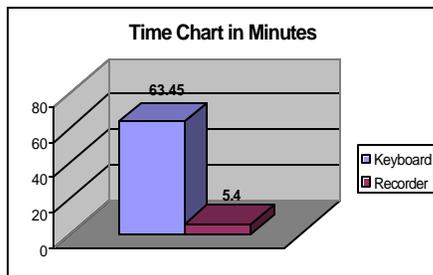


Chart 6

## 4 Conclusion

For numeric data entry the preferred interface was the custom made soft keyboard. The subjects said that it was easier to use because they can choose the desired digit with one tap. On the other interface they had to tap more for the desired number. Also users commented that it was easier to tap on the custom made keyboard because the buttons were bigger.

For textual data entry the users preferred the voice recorder. User comments were that it was easier and faster to use the voice recorder. Although some of them showed some concern about the repercussion that could bring the use of a voice recorder to enter patient information because of the HIPAA law.

### Future Work

There is a last test in schedule. This test will be a continuation of the tests already discussed. It will

compare Graffiti (a unistroke alphabet designed by Palm for hand writing recognition technology) with voice input and the custom made soft keyboard.

## References

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