Design and Implementation of a User Interface of a Smartphone for the Parkinson's Disease Patients

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Abstract—In this paper we present a design of a friendly user interface for the elderly with Parkinson's disease (PD) by using an open source system platform in smartphones. This design provides an interactive interface, a large font, a big button, an intuitive graphical interface, an important feature enhancement and some simplified functions, and it is suitable for the elderly with PD. This design also includes an improved main menu, a selective reply message together with a voice button function, a scrollable full-screen graphical buttons function, a medication calendar with both a list of return appointments and medication reminders of daily living, an easy to operate Web browser and a search engine.

I. INTRODUCTION

Parkinson's disease (PD), one of the most common neurodegenerative disorders, is a widespread illness second in incidence only to Alzheimer's disease over age 50. The current prevalence rates range from 10 to 900 people per 100,000. It is estimated that at least one million people in the United States and roughly seven to 10 million worldwide suffer from PD.

As Parkinson's disease progresses, it becomes increasingly disabling, making daily activities like bathing or dressing difficult or impossible. Many of the symptoms of Parkinson's disease involve motor control, which is the ability to control an individual's muscles and movement.

There are four fundamental PD motor symptoms: tremor, rigidity, bradykinesia (slowness of movement), and postural instability. Other recognized motor signs and symptoms include akinesia, speech and swallowing disturbances including voice disorders, small dull tone conditions and small handwriting [1].

For individuals with PD, rehabilitation should focus on a patient's abilities, rather than on their disability. Our goal is to improve the quality of life for these patients. We hope to increase a patient's ability both to take part in meaningful activities within their environment and to enjoy family events.

Nowadays, there are no smartphone applications designed with a friendly user interface for PD patients [2]. Therefore, we enhance our user's PD interface with the following six functions: 1. Telephone, 2. SMS (Short Message Service), 3. Internet, 4. Medication Calendar, 5. Photo Gallery, and 6. Emergency Button. In addition, we propose to include three major features: (1) a scrollable full screen containing graphical buttons, and (2) a main menu and a select reply message voice button function [3], and (3) a medication calendar. Fig. 1 shows the operation environment of our design.

Fig. 1. Our design's operation environment.

II. APPROACH

A. Mobile Open Source System Platform

In this paper, we use an open source system platform to develop the application program.

B. General Requirements in Dealing with PD

Our approach is based on five suggestions: 1. Using simple language when interacting with PD patients, 2. Repeating instructions several times, 3. Using a less than tri-level interaction operation together with one specific step at a time, 4. allowing the PD patient adequate time either to respond or to react, and 5. sending messages with easy way.

C. The PD application modules and user interface

Figure 2 shows the PD application modules and the user interface.
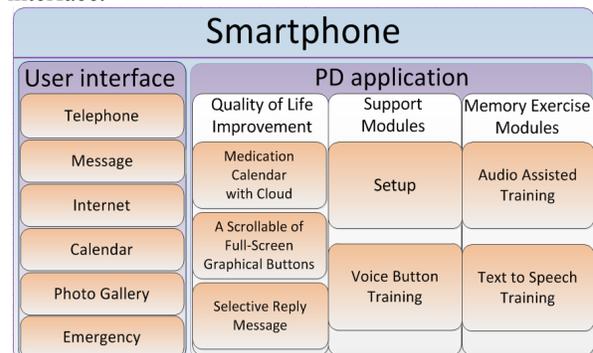

Fig. 2. PD interfaces and application modules.

D.   *The Major Modules of PD Application*

The first PD application module is a scrollable full screen of graphical buttons. Even for those patients who often have tremors just need to touch the screen anywhere. They no longer have to be concerned about the probability of any false clicks. The second module is a medication calendar by means of a cloud with reminders of all daily activities that need to be performed on each day. The application sends the user reminders to take their medication. The third module is an easily selective reply message function.

E.   *Support Modules*

Recorded audio files include both common phrases as an option, such as "Yes, please", "No, thanks", "I understand", "I'm finished", "Good night" and "See you", and words included on the main menu, such as "Telephone," "SMS," "Internet," "Medication Calendar," "Photo Gallery," and "Emergency Button".

Setting the reply message selection: When the user receives a message, the monitor will quickly display the dialog and content. The application includes some common terms for the patients to choose in any situation.

Medication calendar: The user is asked to enter in the medication calendar not only each medication that should be taken on a specific day but also all doctors' appointments.

F.   *Memory Exercise Modules*

Although PD is an incurable disease, some memory training may assist in retaining critical information longer. This module also enables the use of voice recognition techniques to automatically validate the correctness of the patient's responses.

III.   EXPERIMENTAL RESULTS AND COMPARISON

Our design, as shown in Fig. 3 and 4, provides voice buttons with voice feedback function, in order that the patients may reduce the probability of inadvertently touching the wrong button.
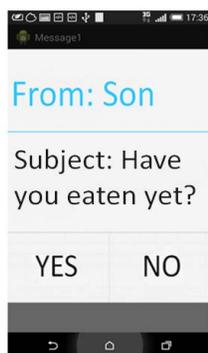

Fig.3. The selective SMS reply of a voice button user interface.

Fig.4. An example of a scrollable full screen main menu with a voice button interface.

The medication calendar interface, as shown in Fig. 5 and 6, provides the user with both reminders to take the medication and the selective options.
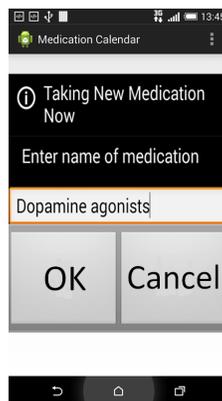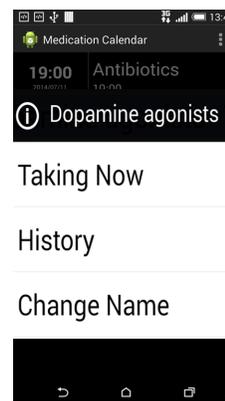

Fig. 5. The medication reminder interface.   Fig.6. The selective options.

Table I shows the comparison of our design with others.

TABLE I
A COMPARISON OF OUR DESIGN WITH OTHERS

Major function	An open source system with easy mode	Design A	Our design
Photo gallery via the cloud	Yes	Yes	Yes
Emergency button	No	Yes	Yes
Medication calendar	No	No	Yes
Selective reply message	No	No	Yes
Voice button	No	No	Yes
Functions for PD patients	No	No	Yes

IV.   CONCLUSIONS

In this paper, we present an open source system platform smartphone application interface design for PD patients with a practical design that is easy for them to use, consisting of a scrollable full screen of graphical buttons for the various necessary functions. In addition, our design is useful, friendly, uses voice buttons to respond, has a double check for patients to select, and a medical calendar function via the cloud to remind them their medication each day.

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