



Implementation of a Personal Digital Assistant as a Hearing Aid Fitting/Programming System

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ABSTRACT

The benefits of Personal Digital Assistants (PDAs), including small size, processing power, intuitive interface, and low cost, make them a natural choice for a fitting system platform. A popular PDA has been implemented as a hearing aid fitting and programming system for a series of DSP hearing aids. It features custom-designed software to calculate, store, and confirm fitting parameters and the ability to transmit data to mainframe storage devices in an easy-to-use, intuitive package.

INTRODUCTION

The 3Com PalmPilot™, a product that is simple, easy-to-use and extremely portable, has established itself as the market leader with 63 percent share in the handheld computing market and distribution in over 35 countries. A flexible architecture for handheld computing, the PalmPilot platform provides an ideal basis for third-party developers and original equipment manufacturers (OEMs) to create and deliver successful mobile computing solutions. This paper describes a commercially available custom application for a family of DSP hearing aids^{1, 2}, setting a new standard for ease-of-use and portability in handheld hearing aid programming systems.

In addition to the ability to quickly and accurately enter audiometric data, verify the accuracy of estimated dynamic ranges, calculate fittings and program hearing aids, and store and communicate fitting information, the PDA still retains all the original features that make it so popular, i.e., scheduling, calculating, data organization and storage, and remote electronic messaging.

One goal of the fitting system is to automate the clinical procedure to the point that more time is available for patient counseling. The system is software driven, leaving it open for modifications and alternative fitting strategies that can be easily added. One of the principle benefits of using DSP architecture with an optimized platform³ in hearing aids is the ability to evolve the system with software additions, something that is easily accomplished with PDAs.

PALMPILOT FUNCTIONALITY

The PalmPilot uses a graphically-based interface that eliminates the need for a computer keyboard. Using a stylus and touch-sensitive screen, the operator points and taps to select applications. Options are available through drop-down menus, and text is entered using an on-screen keyboard or handwriting recognition software called Graffiti.



PalmPilot application screen



PalmPilot address list

All PalmPilots come with a standard set of productivity tools based upon the common features of personal organizers: address book, calculator, date book, expense reports, and memo pad, as well as the ability to communicate electronically (e-mail & PC communication). In addition, software has been written for a wide range of other applications. It is important to remember that *the PalmPilot is a personal computer and its unique user interface and size are what make it special.*

APPLICATION AS A PROGRAMMER

The PalmPilot, like all computers, has a serial interface that allows exchange of information with digital devices, allowing for its use as a programming system. A custom designed, proprietary interface, called the Snap-on-Programmer, attaches to the base of the PalmPilot, and connects to a single Y-cable for programming NATURA™ hearing aids. This single cable solution works with all custom and BTE devices.

The EXPRESSfit™ software uses either a graphic or numeric interface to enter a patient's audiometric information. This information is used to predict the patient's dynamic range at audiometric half-octaves based upon the audiogram and loudness norms. This estimated dynamic range can be verified using tones generated in the hearing aids at each frequency and level.



Figure 1. PalmPilot with Snap-on-Programmer attached

The fitting algorithm maps the dynamic range of normal hearing listeners to the individual's dynamic range as

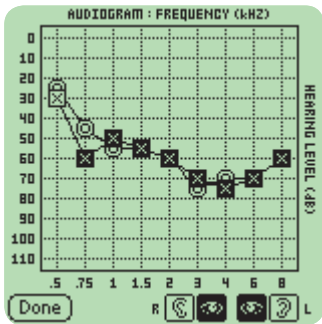


Example of a drop-down menu

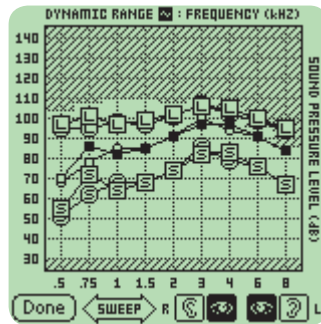


Pop-up keyboard in the Memo Pad

prescribed by the cochlear model used in the design of the hearing aids⁴. Adjustments to the fitting are made on a 9-channel graphic equalizer for soft and loud sounds. The frequency response and compression characteristics in each channel can be adjusted in 1 dB steps with compression ratios ranging from 1:1 to 4:1.



Example of an audiogram



Verify Dynamic Range screen

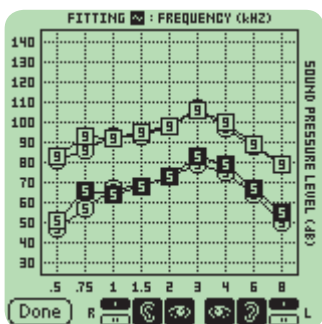
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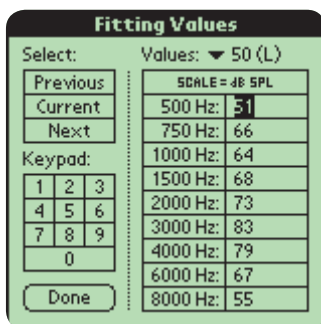
Presented at the American Academy of Audiology 11th Annual Convention on April 29–May 2, 1999, in Miami Beach, Florida.

CLINICAL BENEFIT

The PalmPilot is an efficient, portable, and easy-to-use programming system for a family of state-of-the-art, digital hearing aids. The flexibility of the system and the wide range of fitting parameters are simplified using the PalmPilot's graphical interface, and the proprietary fitting strategy of EXPRESSfit. This ease of use and efficiency results in less chair time, which translates to more time to interact and respond to patients. Greater patient satisfaction can be derived from the speed, efficiency, and high resolution control of EXPRESSfit.



Graphic Fit Hearing Aid interface



Manual entry of fitting values

The PalmPilot also improves access to software changes and upgrades by providing modem access to the **SONIC innovations** server. The two-way modem connection can provide backup for patient records, as well as direct access to communications from **SONIC innovations** Customer Care.

