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06-20-00
EL616942079US

Docket Number:

MJA-20118/03

Al/Pro

PROVISIONAL APPLICATION FOR PATENT COVER SHEET (Large Entity)

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

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TITLE OF THE INVENTION (280 characters max)						
SPEECH RECOGNITION CAPABILITY FOR A PERSONAL DIGITAL ASSISTANT						
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ENCLOSED APPLICATION PARTS (check all that apply)						
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☒ Drawing(s)		Number of Sheets	1			
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government						
☒ No						
☐ Yes, the name of the U S Government agency and the Government contract number are						

Respectfully submitted,

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DATE 6/16/00

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**SPEECH RECOGNITION CAPABILITY
FOR A PERSONAL DIGITAL ASSISTANT**

Personal digital assistants (PDAs), such as Palm Pilots, Handspring Visors, hand-held PCs, and similar devices, have become incredibly popular because of their functionality and flexibility. For purposes of this application, PDAs should be understood to include all portable computing devices, including laptops, hand-helds, palm tops, cellular phones with
5 computing capability, two-way paging devices, and any other device that includes a computing capability and is designed to be portable. However, for ease of description, this application will focus on the Palm Pilot family of hand-held devices and the Handspring Visor.

These PDAs include buttons and touch sensitive screens allowing input of data in a
10 variety of ways, including various forms of handwriting recognition and simplified keyboards. For some users and applications, these forms of data input are insufficient. For example, a user who wishes to input information, such as recording what meals were eaten during a day or expenses incurred on a trip, must grasp an input stylus with one hand while holding the PDA in the other hand. The stylus is then used to touch the touch sensitive screen in a
15 manner indicative of the input desired. This obviously ties up both of the user's hands, and requires a moderate level of visual and mental focus. It would be more desirable if data input could be made using your voice, rather than manual manipulation.

A partial solution is offered by some hand-helds which include voice recording capability. A user who wishes to quickly record information on the PDA presses a record

button and speaks into a microphone. Later, the recorded information may be played back. Unfortunately, this approach falls far short of what is desirable. The voice recording is only voice-to-voice and therefore someone must later listen to the recorded voice and manually input the data. While the original recording step may be easier than manual manipulation, manual manipulation is not avoided because it must be completed at a later time. More desirable would be a voice-to-text voice recognition capability so that a user may speak commands and information and the PDA responds to the commands and records the information in text form. However, voice-to-text speech recognition is extremely complex and requires powerful computer processors and a large data storage capability. Current PDAs offer only a fraction of the necessary processing power and storage.

According to the present invention, the limitations of currently available PDAs and voice recognition software are overcome by offering a simplified voice recognition program and software designed to work with this simplified voice recognition capability. Much of the complexity of voice recognition software comes from the huge variety of words in a given language and the similarity in sounds of many of these words. The software must be capable of very accurately capturing the spoken sounds. Then, the software must determine what word was spoken out of a variety of similar choices by analyzing the context of the word, statistical likelihood, and past usage by a given user. Also, users do not consistently pronounce words so software must be "trained" to recognize a specific user. The speech recognition challenge is significantly reduced by artificially constraining the vocabulary the software and hardware must interpret. Examples of restricted vocabulary speech recognition

are currently used on many telephone systems, allowing users to either press a number 0 through 9 or to speak the number. In this situation, the speech recognition software must only recognize and distinguish between ten choices, all of which are reasonably distinct.

According to the present invention, a similar capability is provided to PDAs. In a preferred embodiment, the PDA is capable of recognizing numbers 0 through 9 when they are spoken by a user. Current PDAs do not have this hardware or software capability. However, software may be added to most PDAs. Also, most PDAs are capable of accepting add-on hardware modules. For example, the Handspring Visor has a slot arrangement on its back side known as a springboard. A variety of hardware modules, such as memory modules, may be inserted into the springboard to enhance the capability of the Handspring Visor. Likewise, the Palm Pilot family of hand-held PDAs accept clip-on hardware modules to enhance their capabilities. It is expected that future versions of PDAs will include new and simplified hardware attachment capabilities.

Typically, a hardware module which is inserted into or attached to a PDA may also include application software further enhancing the capabilities of the PDA and taking advantage of the additional hardware. For example, the Handspring Visor accepts numerous springboard compatible hardware modules, such as digital camera modules and music recording and playback modules. These modules interconnect with the springboard portion of the Handspring Visor and include hardware such as a digital camera lens and related electronics, or music recording and playback hardware. This add-on hardware cooperates with the existing capabilities of the Handspring Visor to provide the capabilities of a digital

camera or digital music player and recorder. The hardware modules also include onboard software which is accessed and used by the hardware of the Handspring Visor and the add-on hardware module. The software allows the module and Handspring Visor to communicate and provide the enhanced capabilities. Likewise, hardware modules such as wireless modems
5 may be interconnected with some members of the Palm Pilot family.

According to the present invention, a hardware module is provided which interconnects with a PDA. The hardware module includes a microphone for receiving speech and may include other controls such as an on-off switch and sensitivity adjustments. An example of the present invention is shown schematically in Figures 1 and 2. The PDA 10
10 receives a hardware module 12 which, in the figures, slides into a slot in the back side of the PDA 10. The hardware module 12 includes a microphone 14 located near the edge of the module so that it is on the upper side of the PDA in use. In PDAs already including a microphone, this may be left off of the module. The module preferably includes both hardware and software so that when it is inserted in the slot in the PDA, the PDA becomes
15 capable of simplified speech recognition.

Referring now to Figures 3-5, an example use for the simplified speech recognition module will be explained. In the figures, the PDA is shown displaying textual menus for providing a number of choices. In this example, the PDA is being used to record dietary intake. In Figure 3, the PDA presents a menu with six options for meal type. Software
20 providing the dietary intake software may be part of the same module 12, an additional module, or may be software loaded into, or already part of, the PDA. Using the voice

recognition module, the user merely speaks the number of their choice of meal type. For example, if the user wishes to input information related to breakfast, they say the word “one.” This is equivalent to entering the number 1 using the stylus or button on the PDA. This choice brings up a second menu, as shown in Figure 4. In this menu, several breakfast
5 choices are displayed. If the user wishes to choose hot cereal, they pronounce the word “two.” This, once again, enters the choice into the software causing the software to bring up a third menu, as shown in Figure 5. This third menu presents a variety of choices for hot cereal. It will be clear to those of skill in the art how this process may continue, in a very simplified manner, allowing a user to choose items for their diet. This may be similarly applied to data
10 entry chores such as expense account tracking.

As known to those of skill in the art, a very wide variety of software applications are available for PDAs. According to the present invention, the hardware module and the software it carries are designed to work with many of the software applications. That is, the hardware and software module integrates with and communicates with a PDA such that
15 speaking a number provides the same input to the software running on the PDA as if the user had used a stylus to input the number. Also, additional vocabulary may be provided in the same hardware module, or another hardware module according to the present invention. For example, many PDA functions require the use of up and down buttons. For this purpose, the hardware module may also recognize the commands “up” and “down.” Commands could
20 also be recognized for a few of the most commonly used functions of the PDA, such as “date” for date book, “to do” for the to do list, and “address” or “phone” for the address list. The

hardware module may also recognize a few letters such as A through J, or the entire alphabet. Obviously, the speech recognition capabilities are entirely dependent on the complexity of the hardware and software in the module. Therefore, for some applications a very simple speech recognition module may be sufficient. In this case, recognizing numerals 0 through 9 may be
5 more than sufficient. As the software and hardware capabilities of PDAs improve, more complex modules may be desirable for some applications.

As will be clear to those of skill in the art, the present invention provides numerous advantages in the input of data. In the example given earlier in entering diet information, the user may simply enter their choices by quickly repeating the words “one,” “two,” “one.” This
10 may be both easier and more pleasant than manual input for many users. Also, some users may have limited dexterity, making use of the stylus very difficult. The speech recognition module allows single handed, or even hands free, use since the stylus need not be grasped.

Other variations on the disclosed embodiments of the present invention will be apparent to those of skill in the art. These variations do not depart from either the spirit or
15 scope of the present invention, and therefore the disclosed embodiment should be interpreted broadly.

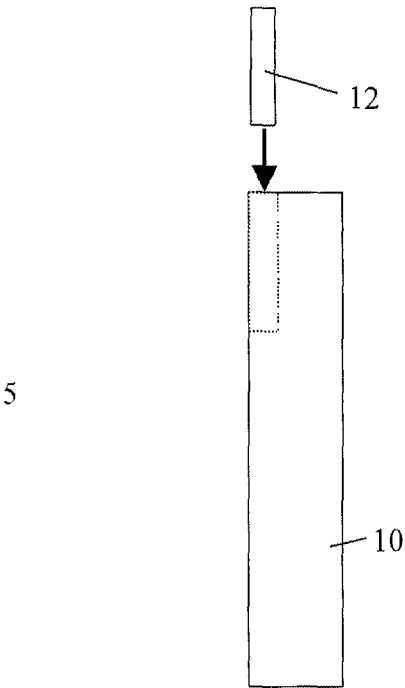
Exemplary claim

1. A simplified speech recognition module for a personal digital assistant,
comprising:

a module housing configured to engage with an accessory feature of the PDA;

5 a voice receiving device for receiving voice commands from the user;

a voice recognition means capable of distinguishing multiple speech commands and
communicating a corresponding set of electrical commands to the PDA.



Figures 1

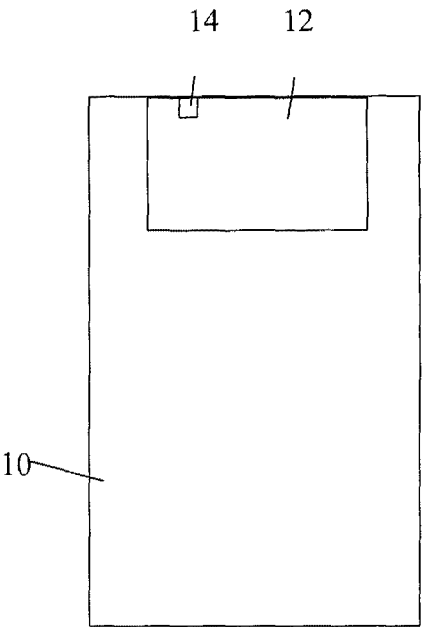


Figure 2

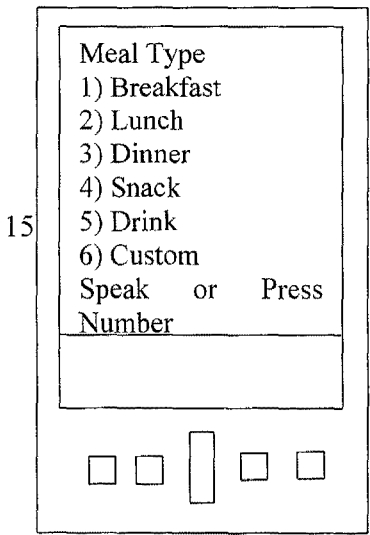


Figure 3

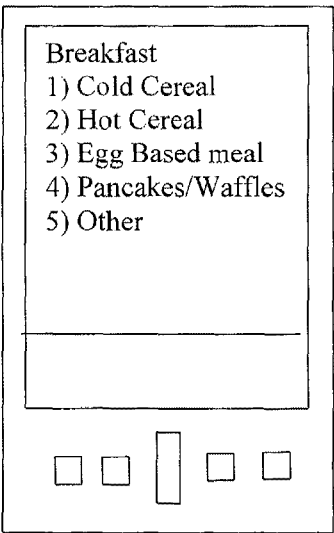


Figure 4

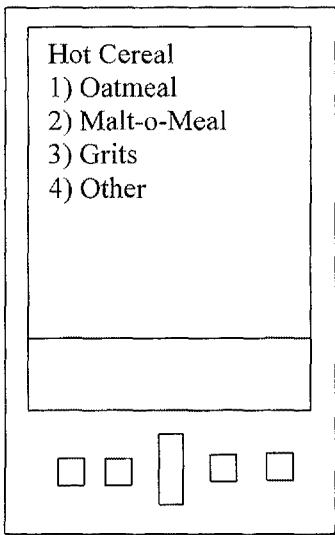


Figure 5