A speech generation device is disclosed. The device includes casing features that allow it to be operated as a handheld device that is both portable and easy for a user to hold in his hands and operate to generate speech. Specific casing components may include opposing sides of an outer shell that are shaped in a convex fashion and with a predetermined thickness to fit within the palms of a user's hands. When a user positions his fingers/hands around the casing components of the device, thus operating the device as a handheld device, the first and second extensions may be positioned on the bottom surface of the device and an outer speaker grille may be positioned to face outward from the user so that audio output from the device radiates outwardly from the user.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
HAND-HELD SPEECH GENERATION DEVICE

PRIORITY CLAIM
[0001] This application claims the benefit of previously filed U.S. Provisional Patent Application entitled "HAND-HELD SPEECH GENERATION DEVICE," assigned USSN 61/228,256, filed July 24, 2009, and which is fully incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION
[0002] The present invention generally pertains to speech generation devices, and more particularly to portable speech generation devices.
[0003] Various debilitating physical conditions, whether resulting from disease or injuries, can deprive the afflicted person of the ability to communicate audibly with persons or devices in one's environment in real time. Injuries suffered during armed combat, whether by domestic police officers or by soldiers engaged in battle zones in foreign theaters, are swelling the population of potential users. Persons lacking the ability to communicate audibly can compensate for this deficiency by the use of speech generation devices. Some conventional speech generation devices are desktop devices, while others are rendered portable by being mounted on vehicles such as wheel chairs, and still other conventional portable speech generation devices can be carried by user as one would carry a brief case.
[0004] It is estimated that less than 10% of the potential users of speech generation devices currently is being served by conventional speech generation devices. This population is highly variable from the standpoint of a range in ages from preschool children through elderly adults and a variety of lifestyles, geographic locations, educational attainments, language sophistication, and available physical motor skills to operate the speech generation device.
[0005] Some speech generation devices, while portable, consume large amounts of power and must be located near an electrical outlet, and this requirement limits freedom
of movement of the user. Other conventional speech generation devices seek to overcome this problem with the provision of a battery, but in order to provide sufficient battery life, these so-called portable SGD’s weigh five (5) pounds to seven (7) pounds and/or must be recharged within two (2) or three (3) hours. Because of the substantial power consumption, heat generation can be a problem in some conventional SGDs. While this problem can be addressed by the provision of fans, this solution tends to increase the size and weight of the SGD.

[0006] Conventional speech generation devices typically have dedicated processors, and the user is not given the ability to run other applications on the device. While some speech generation devices provide a touch panel screen and thus have eliminated the need for a keyboard separate from the display panel, such touch screens are subject to false activations, which is especially a problem given the limited fine motor skills of some of the intended users. Notwithstanding the use of a molded fixotrophic plastic, thick-walled case, most of the conventional SGDs are rendered inoperable and require repair upon being dropped or subjected to a moisture rich environment.

[0007] Due to the desire to limit the overall size, weight, and power consumption requirements, conventional SGDs are largely limited to the speech generation function that enables the user to communicate with other persons in the immediate vicinity of the user.

**BRIEF SUMMARY OF THE INVENTION**

[0008] In general, the present subject matter is directed to an improved speech generation device (SGD) having electronic components that enable the SGD to transmit and receive messages to assist a user in communicating with others. For example, the SGD may correspond to a particular special-purpose electronic device that permits a user to communicate with others by producing digitized or synthesized speech based on configured messages. Such messages may be preconfigured and/or selected and/or composed by a user within a message window provided as part of the speech generation device user interface. A variety of physical input devices and software interface features may be provided to facilitate the capture of user input to define what information should be displayed in a message window and ultimately communicated to others as spoken output, text message, phone call, e-mail or other outgoing communication.
One exemplary SGD embodiment includes casing features that enable the SGD to be operated as a hand-held device that is both portable and easy for a user to hold in his hands and operate to generate speech and accomplish additional functions. Specific casing components to accomplish such features may include first and second opposing sides of an outer shell that are shaped in a convex fashion and with a predetermined thickness to fit within the palms of a user’s hands. First and second generally convex extensions may extend from a bottom casing component to provide an ergonomic configuration for facilitated location and grip of a user’s fingers. When a user positions his fingers/hands around the casing components of the SGD device, thus operating the SGD as a hand-held device, the first and second extensions may be positioned on the bottom surface of the SGD and an outer speaker grille may be positioned to face outward from the user so that audio output from the SGD radiates outwardly from the user to others within a user’s environment.

In one exemplary SGD embodiment, one or more outer casing components are made from magnesium or an alloy thereof. When magnesium is used in the casing components, it enables the case to be an active functional component and not just a protective component. For example, the magnesium case provides conductive and radiated immunity to the components mounted within the magnesium case without requiring separate shielding. The magnesium case also provides heat dissipation features for an SGD by coupling the microprocessor to the case.

In another exemplary SGD embodiment, a capacitive touch screen is provided as an input device for the SGD instead of a keyboard, a mouse or a pressure sensitive touchscreen. Inclusion of such a feature is advantageous because active sensing material can be applied to the back of any transparent material to achieve a thin and lightweight design. Multi-touch interaction is enabled and the need for recalibrations that may be needed with resistive or pressure-sensitive touch screens is obviated. In addition, use of a capacitive touch panel which requires no activation force but only a slight contact, is an advantage for a user who may have motor control limitations.

In still further exemplary SGD embodiments, hardware components may also include various communications devices and/or modules and related communications functionality. For example, a wireless network adapter may be included to provide integrated Internet access. An RF device may be included as an integrated cell phone to enable the user to send and receive text messages and phone calls directly and
speak during the phone conversation using the SGD, thereby eliminating the need for a separate telephone device. An infrared (IR) transceiver may be provided to function as a universal remote control for the SGD that can operate devices in the user's environment, for example including TV, DVD player, and CD player. A Bluetooth interface may be included to provide Bluetooth radio signals that can be used to control a desktop computer, which appears on the SGD's display as a mouse and keyboard, or other Bluetooth-enabled devices.

[0013] Additional features that may be included in exemplary SGD embodiments concern computer readable medium that, when executed by a processor, instruct the SGD to perform specific functionality. For example, instructions stored in SGD memory may adapt the device to perform integrated web access for vocabulary generation in which content is selected from the Internet, and useful terms, phrases and/or images are extracted and available for immediate use in aided communication via the SGD.

[0014] Another feature that may be provided in exemplary SGD embodiments corresponds to a voice inflection mark up feature that can add inflection or other speech style to the speech output of the SGD or that can add a predefined speech effect. Exemplary speech styles for modifying text may be defined in accordance with a variety of parameters, including but not limited to voice, volume, pitch, speech rate, spell mode, emphasis and context. Exemplary speech effects that may be inserted into a communicated message may include but are not limited to coughing, laughing, crying, kissing, sniffing, swallowing, sighing, whistling, yawning, or making noises such as "eh", "oh", "mmm", etc. The selected speech styles and effects can help communicate different meanings just based on the different inflections imposed on different syllables of the words being spoken by the SGD. In addition, such speech modifiers provide more interactive and enjoyable communication by an SGD user.

[0015] Exemplary SGD embodiments may further include executable instructions stored on a computer-readable medium that implement a unique method of communication rate enhancement that combines sentences and phrases with slot fillers. In general, implementation of a "slots" feature triggers software provision of mechanisms to insert a "slot" or placeholder in a text phrase. Each one of these placeholders is associated with a list of "fillers" that can potentially fill in this place in the text. The list of slots and their associated fillers are stored in a database associated with other computer readable medium storing computer executable instructions for implementing the rate enhancement functionality.
Generally, the technical effect of the disclosed computer-implemented methods is to enhance the operation and functionality of the speech generation device of the present subject matter.

Additional objects and advantages of the invention will be set forth in part in the description that follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate at least one presently preferred embodiment of the invention as well as some alternative embodiments. These drawings, together with the description, serve to explain the principles of the invention but by no means are intended to be exhaustive of all of the possible manifestations of the invention.

Fig. 1 provides a perspective view of a first exemplary embodiment of a portable speech generation device in accordance with an aspect of the present invention;

Fig. 2 provides another perspective view of a first exemplary embodiment of a portable speech generation device in accordance with an aspect of the present invention;

Fig. 3 provides an exploded view of a first exemplary embodiment of a portable speech generation device in accordance with an aspect of the present invention;

Fig. 4 provides a perspective view of a second exemplary embodiment of a portable speech generation device in accordance with an aspect of the present invention;

Fig. 5 provides a perspective view of a second exemplary embodiment of a portable speech generation device in accordance with an aspect of the present invention;

Fig. 6 provides an exploded view of a second exemplary embodiment of a portable speech generation device in accordance with an aspect of the present invention;
[0025] Fig. 7 provides a schematic diagram of exemplary hardware components for use within a speech generation device in accordance with an aspect of the present invention;

[0026] Fig. 8 provides an exemplary embodiment of a graphical user interface menu for providing a phone contacts menu for use with a cellular phone integrated with a speech generation device;

[0027] Fig. 9 provides an exemplary embodiment of a graphical user interface for providing a contact editing menu for use with a cellular phone integrated with a speech generation device;

[0028] Fig. 10 provides an exemplary embodiment of a graphical user interface menu for providing a phone menu for use with a cellular phone integrated with a speech generation device;

[0029] Fig. 11 provides an exemplary embodiment of a graphical user interface menu for providing a text messaging menu for use with a cellular phone integrated with a speech generation device;

[0030] Fig. 12 provides an exemplary embodiment of a graphical user interface menu for providing a web browser with menu bar use to access the internet with a speech generation device;

[0031] Fig. 13 provides an exemplary embodiment of a graphical user interface menu for selecting text from a web page;

[0032] Fig. 14 provides an exemplary embodiment of a graphical user interface menu for providing a vocabulary list box based on information captured from the internet;

[0033] Fig. 15 provides an exemplary embodiment of a graphical user interface menu for importing an online picture for use as symbols;

[0034] Fig. 16 provides a flow chart of an exemplary method for integrating text from a vocabulary source into a user vocabulary list;

[0035] Fig. 17 provides an exemplary embodiment of a graphical user interface menu for displaying an embedded vocabulary list in a vocabulary list box;

[0036] Fig. 18 provides a first view of an embodiment of a graphical user interface menu provided via software features for implementing slots and fillers;

[0037] Fig. 19 provides a second view of an embodiment of a graphical user interface menu provided via software features for implementing slots and fillers;
Fig. 20 provides a flow chart of an exemplary method for implementing speech styles and effects in spoken text;

Fig. 21 provides an exemplary embodiment of a graphical user interface menu for displaying integrated speech effects and styles as marked up text;

Fig. 22 provides an exemplary embodiment of a graphical user interface menu for displaying a speech style editor;

Fig. 23 provides an exemplary embodiment of a graphical user interface menu for displaying a speech effect editor;

Fig. 24 provides an exemplary embodiment of a graphical user interface menu for implementing Bluetooth functionality associated with an SGD;

Fig. 25A provides an exploded view of portions the speech generation device illustrated in Fig. 1 in accordance with an aspect of the present invention; and

Fig. 25B provides an inverted exploded view of the portions of the speech generation device illustrated in FIG. 25A in accordance with an aspect of the present invention.

***DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS***

Reference now will be made in detail to the presently preferred embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. Each example is provided by way of explanation of the invention, which is not restricted to the specifics of the examples. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment, can be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

Referring now to the drawings, Figs. 1-3 illustrate the various structural components of a first exemplary embodiment of a speech generation device (SGD) 100 in accordance with an aspect of the present invention. Structural components of a second exemplary SGD embodiment 400 are shown in and discussed with reference to Figs. 4-6. The internal hardware and software components and related functionality of both SGDs 100 and 400 may be as described with reference to Figs. 7-24. It should be appreciated that specific embodiments of an SGD in accordance with the disclosed
technology should not be limited by the complete spectrum of hardware and software components described herein. Instead, an SGD may selectively incorporate one or more of such disclosed features and steps and others to create additional and alternative embodiments.

[0047] As shown in Figs. 1-3, a first exemplary SGD 100 corresponds to a hand-held device that is both portable and easy for a user to hold in his hands and operate to generate speech and accomplish additional functions as described herein. SGD 100 may include one or more outer housing, or casing components, such as a top casing component 102, a first bottom casing component 104 and a second bottom casing component 106. In one embodiment, a battery is stored between the first and second bottom casing components 104 and 106, with or without the inclusion of a metal plating cover to help secure the battery therein. The top casing component 102 and second bottom casing component 106, together with speaker grille 108 collectively form the outer shell for SGD 100. Second bottom casing component 106 forms the bottommost surface of the outer shell.

[0048] Various features of the outer shell of SGD 100 are provided to accommodate portability of SGD 100 within a user's hands. First and second opposing sides 110 and 112 of the outer shell formed by casing components 102-106 are generally shaped in a convex fashion and with a predetermined thickness to fit within the palms of a user's hands. First and second generally convex extensions 114 and 116 extend from the second bottom casing component 106 to provide an ergonomic configuration for facilitated location and grip of a user's fingers. First and second convex extensions 114 and 116 generally extend along second bottom casing component 106 from the speaker grille 108 forming a front surface of SGD 100 towards a rear surface of SGD 100. Extensions 114 and 116 may taper towards the rear surface of SGD 100. First extension 114 may be provided generally adjacent or near to the first side 110 of second bottom casing component 106, while second extension 116 may be provided generally adjacent or near to the second side 112 of the second bottom casing component 106. When a user positions his fingers/hands around the casing components of the SGD device, thus operating the SGD as a hand-held device, the first and second extensions 114 and 116 may be positioned on the bottom surface of the SGD and the outer speaker grille 108 may be positioned to face outward from the user so that audio output from the SGD radiates outwardly to others within a user's environment.
Referring still to the outer shell formed by the casing components of SGD 100, top casing component 102 may include a recessed area 118 or other feature for accommodating an outer touch screen 120. Top casing component 102 may also be formed to define a relatively large opening 122 therethrough to provide access to a display panel 124 which may be viewed through touch screen 120. Touch screen 120 may generally serve as an input feature for SGD 100, and is described later in more detail. Display panel 124 may generally serve as an output feature for SGD 100 and is also described later in more detail.

The casing components forming the outer shell of SGD 100 may also be formed to define additional openings to accommodate data input and output. For example, an opening 126 within top casing component 102 may be provided through which an LED or other light source can provide a device power indicator light. An opening 128 can provide a location for a button by which a user can toggle the power for SGD 100 in an "on" or "off" position. Another opening 130 formed within one or more casing components can provide a location for data input/output ports. Speaker grille 108 may be formed to define a first opening 132 for accommodating a volume control knob to control the volume of speakers associated with SGD 100, as well as a second opening 134 to provide a location for a USB port through which various peripheral devices may be coupled to SGD 100.

One or more printed circuit boards (PCBs) may also be provided as structural components within SGD 100, and may be housed between top casing component 102 and first bottom casing component 104. For example, a PCB may be provided as a mounting surface or motherboard for such hardware and/or electronics components as a computer processing unit, hard drive(s) and/or other associated memory or media device(s). One or more PCBs may also serve as a mounting surface for radio or wireless communications modules, antennas, data buses, related integrated circuits and passive devices, and the like. First and second speakers 136 may also be positioned among and/or securely mounted to the PCBs and/or casing components. As shown in Fig. 3, speakers 136 may be respectively coupled via a first connection to first bottom casing component 104 and via a second connection to an associated PCB.

Various connectors may be used to establish relative positioning among the various casing components and secure the components to form an integrated assembly. For example, mating holes, pins and standoffs may be used to orient
adjacent casing components to one another. Snap-fit features, threaded screws and/or other connectors may be used to secure and connect the casing components together.

[0053] A second exemplary embodiment of a speech generation device is shown in Figs. 4-6, respectively. From a functional perspective, such embodiment 400 may include some or all of the same or similar internal hardware and software features as the first exemplary embodiment of Fig. 1-3. The overall size and dimension of SGD 400 compared to SGD 100 may vary. For example, one exemplary embodiment of SGD 100 corresponds to a size with dimensions 6.1 x 4 x 1.9. One exemplary embodiment of SGD 400 corresponds to a size with dimensions 10.8 x 8.5 x 1.9. The SGD can incorporate one or more of the foregoing features and yet weigh less than 2 pounds when including a 5 1/4-inch diagonal display and less than 3 pounds when incorporating at least a 10-inch display screen.

[0054] Referring now to Figs. 4-6, SGD 400 generally includes several structural components, including a display lens 402, a top casing component 404, an internal casing component 406, a bottom casing component 408, a speaker grille 410 and a battery door 412. Display lens 402 may be a protective covering or may correspond to the outer surface of a touch-screen LCD or other display device for use with SGD 400, as described later. Top casing component 404 is formed to define an opening therein for accepting the display lens 402 and for providing viewing access to a display device. An upper peripheral surface of top casing component 404 may be formed with a material (e.g., chrome) selected to highlight the outer perimeter of SGD 400 as viewed by a user and to place emphasis on the relatively thin edge profile of SGD 400. Internal casing component 406 provides a structural support and backer for the device display. Internal hardware components separate from the display may be mounted and secured between the internal casing component 406 and the bottom casing component 408. Bottom casing component 408 may be formed to define a first opening 414 to access data input/output (I/O) ports. Opening 414 may be secured with a data door that can be flush with the surrounding surface of bottom casing component 408. Bottom casing component 408 may also be formed with a second opening by which a user may access a battery associated with SGD 400. The battery door 412 with latch feature is provided for securing the battery within second opening.

[0055] Similar to the generally ergonomic features of SGD 100, first and second opposing sides 430 and 432 of the outer shell formed by casing components 404 and 408 are generally shaped in a convex fashion and with a predetermined thickness to fit
within the palms of a user’s hands. Additionally, the bottom casing component 408 of SGD 400 may also include first and second generally convex extensions 418 and 420 projecting from a lower surface of bottom casing component 408. First and second convex extensions 418 and 420 generally extend along second bottom casing component 408 from the speaker grille 410 forming a front surface of SGD 400 towards a rear surface of SGD 400. Extensions 418 and 420 may taper towards the rear surface of SGD 400. First extension 418 may be provided generally adjacent or near to the first side of bottom casing component 408, while second extension 420 may be provided generally adjacent or near to the second side of the bottom casing component 408. Further, the first and second extensions 418 and 420 may define generally concave shaped recessed areas 434 and 436, which may also serve as ergonomic features of the SGD 400. For example, the concave recessed areas 434 and 436 may be configured to facilitate location and grip of a user’s fingers as they are wrapped around the first and second extensions 418 and 420.

[0056] The outer casing components used in first and second exemplary SGD embodiments 100 and 400 may be molded from any substantially rigid and lightweight material. In one embodiment, one or more outer casing components are made from a material such as but not limited to plastic, thermoplastic, polymer, polyethylene, or resin material. In another embodiment, one or more outer casing components (particularly the bottom casing components) are made from magnesium or an alloy thereof. When magnesium is used in the casing components, it provides several advantages for an SGD and enables the case to be an active functional component and not just a protective component.

[0057] First, a magnesium casing provides conductive and radiated immunity to the components mounted within the magnesium case without requiring separate shielding. The magnesium prevents intrusion of radiated conducted emissions that otherwise might effect the electronic components of the SGD disposed within the case. The physical properties of the magnesium also provide a superior shielding from electromagnetic interference (EMI) signals. Typically plastic enclosures need a metal shield or shielding directly on components on the PCB to provide protection from radiated and conducted emissions.

[0058] A magnesium case also provides heat dissipation features for an SGD. In particular, one or more of the heat generating components of the SGD may be thermally coupled to the magnesium case to enable the case to function as a heat sink.
example, referring to Figs. 25A and 25B, exploded views of several of the components of the SGD 100 illustrated in Figs. 1-3 are depicted. As shown, the SGD’s microprocessors 180 are mounted on a circuit board 182 of the SGD 100. Additionally, to enable heat generated from the microprocessors 180 to be conducted through the magnesium case, the microprocessors 180 may be coupled to any suitable thermally conductive plates 184, such as plates formed from aluminum or various other metals. The thermally conductive plates 184 may then be directly coupled to a portion of the magnesium case, such as an inner surface 186 of the the bottom casing component 106 of the magnesium case. Thus, any heat generated by the microprocessors 180 may be conducted through the thermally conductive plates 184 and into the bottom casing component 106. It should be appreciated that the processors 180 may be coupled to the plates 184 and the plates 184 may be coupled to the casing component 106 using any suitable means, such as by welding the components together or using mechanical fasteners (e.g., screws, bolts and the like). Additionally, in an alternative embodiment, the microprocessors 180 may be directly coupled to the magnesium case to provide heat transfer directly from the microprocessors 180 to the case. Regardless, such heat dissipation features can eliminate the need for cooling fans, which conserves the power demands on the SGD’s lithium polymer battery, reduces the SGD’s background noise level, which is especially desirable for a speaking device, and eliminates moving parts of the fan that otherwise are subject to breakage upon dropping of the SGD and therefore improves the overall durability of the SGD.

[0059] Additionally, the magnesium case provides greater structural integrity with low weight and high strength than conventional plastic casings. In particular, it permits the walls of the case to be thinner than would be the situation in a fixotropic molded plastic case in a conventional SGD. The strength to weight ratio of the magnesium case thus is also greater than might otherwise be if molded from fixotropic plastic requiring thicker walls in order to achieve the same durability or even less durability than is possible with the magnesium case of the present invention. Injection molding magnesium produces better complex net shape requiring less machining and secondary operations. Bosses can be drilled and tapped thus eliminating the need for inserts or self-tapping screws which allow the case to be vibration and resonance free, thus improving the sound quality.

[0060] Electronic components intended for selective use with a speech generation device in accordance with aspects of the present invention are shown in Fig. 7. The
electronic components may include a combination of hardware, software and/or firmware elements, all of which either correspond to physical tangible apparatuses or which are embedded as instructions on a physical and tangible apparatus such as a computer-readable storage medium.

[0061] In general, the electronic components of an SGD enable the device to transmit and receive messages to assist a user in communicating with others. For example, the SGD may correspond to a particular special-purpose electronic device that permits a user to communicate with others by producing digitized or synthesized speech based on configured messages. Such messages may be preconfigured and/or selected and/or composed by a user within a message window provided as part of the speech generation device user interface. As will be described in more detail below, a variety of physical input devices and software interface features may be provided to facilitate the capture of user input to define what information should be displayed in a message window and ultimately communicated to others as spoken output, text message, phone call, e-mail or other outgoing communication.

[0062] Referring now to Fig. 7, central computing device 700 may include a variety of internal and/or peripheral components. Power to such devices may be provided from a battery 703, such as but not limited to a lithium polymer battery or other rechargeable energy source. A power switch or button 705 may be provided as an interface to toggle the power connection between the battery 703 and the other hardware components. In addition to the specific devices discussed herein, it should be appreciated that any peripheral hardware device 707 may be provided and interfaced to the speech generation device via a USB port 709 or other communicative coupling. It should be further appreciated that the components shown in Fig. 7 may be provided in different configurations and may be provided with different arrangements of direct and/or indirect physical and communicative links to perform the desired functionality of such components.

[0063] Referring more particularly to the exemplary hardware shown in Fig. 7, a central computing device 700 is provided to function as the central controller within a SGD and may generally include such components as at least one memory/media element or database for storing data and software instructions as well as at least one processor. In the particular example of Fig. 7, one or more processor(s) 702 and associated memory/media devices 704a and 704b are configured to perform a variety of computer-implemented functions (i.e., software-based data services). One or more
processor(s) 702 within computing device 700 may be configured for operation with any predetermined operating systems, such as, but not limited to, Windows XP, and thus is an open system that is capable of running any application that can be run on Windows XP. Other possible operating systems include BSD UNIX, Darwin (Mac OS X), Linux, SunOS (Solaris/OpenSolaris), and Windows NT (XP/Vista/7).

At least one memory/media device (e.g., device 704a in Fig. 7) is dedicated to storing software and/or firmware in the form of computer-readable and executable instructions that will be implemented by the one or more processor(s) 702. Other memory/media devices (e.g., memory/media devices 704b) are used to store data which will also be accessible by the processors 702 and which will be acted on per the software instructions stored in memory/media device 704a. The various memory/media devices of Fig. 7 may be provided as a single or multiple portions of one or more varieties of computer-readable media, such as, but not limited to, any combination of volatile memory (e.g., random access memory (RAM, such as DRAM, SRAM, etc.)) and nonvolatile memory (e.g., ROM, flash, hard drives, magnetic tapes, CD-ROM, DVD-ROM, etc.) or any other memory devices including diskettes, drives, other magnetic-based storage media, optical storage media and others. In some embodiments, at least one memory device corresponds to an electromechanical hard drive and/or or a solid state drive (e.g., a flash drive) that easily withstands shocks, for example that may occur if the SGD is dropped. Although Fig. 7 shows two separate memory/media devices 704a and 704b, the content dedicated to such devices may actually be stored in one memory/media device or in multiple devices. Any such possible variations and other variations of data storage will be appreciated by one of ordinary skill in the art.

In one particular embodiment of the present subject matter, a first portion of memory/media device 704b is configured to store input data received from a user for performing the desired functional steps associated with a speech generation device. For example, data in memory 704b may include inputs received from one or more peripheral devices, including but not limited to touch screen 706, microphone 708 and other peripheral devices 710, which indicate a user’s selections of text to be spoken by the SGD or other related actions. Memory device 704a includes computer-executable software instructions that can be read and executed by processor(s) 702 to act on the data stored in memory/media device 704b to create new output data (e.g., audio signals, display signals, RF communication signals and the like) for temporary or permanent storage in one of the memory/media devices. Such output data may be
communicated to a peripheral output device, such as display device 712, speakers 714, cellular phone or RF device 716, wireless network adapter 718, or as control signals to still further components. Computing/processing device(s) 702 may be adapted to operate as a special-purpose machine by executing the software instructions rendered in a computer-readable form stored in memory/media element 704a. When software is used, any suitable programming, scripting, or other type of language or combinations of languages may be used to implement the teachings contained herein. In other embodiments, the methods disclosed herein may alternatively be implemented by hard-wired logic or other circuitry, including, but not limited to application-specific circuits. The steps, features and algorithms described later, including but not limited to algorithms for extracting web words, implementing slots and fillers, utilizing vocabulary lists, applying speech inflection styles and effects, and the like, are provided as executable software instructions stored in the computer-readable medium of elements 704a and/or 704b or others.

Referring still to Fig. 7, various input devices may be part of an SGD and communicatively coupled to the computing device 700. For example, a touch screen 706 may be provided to capture user inputs directed to a display location by a user hand or stylus. A microphone 708, for example a surface mount CMOS/MEMS silicon-based microphone such as offered for sale by Knowles Acoustics, a division of Knowles Electronics of Itasca, Illinois, may be provided to capture user audio inputs. Other exemplary input devices (e.g., peripheral device 710) may include but are not limited to a peripheral keyboard, peripheral touch-screen monitor, peripheral microphone, mouse and the like.

In one particular example, touch screen 706 includes a projective capacitive touchscreen instead of a keyboard, a mouse or a pressure sensitive touchscreen. A capacitive touchscreen panel is a sensor typically made of glass coated with a transparent conductor such as indium tin oxide (ITO). This type of sensor is basically a capacitor in which the plates are the overlapping areas between the horizontal and vertical axes in a grid pattern. Since the human body also conducts electricity, a touch on the surface of the sensor will affect the electric field and create a measurable change in the capacitance of the device. Thus, a transparent rigid panel covers the display screen and prevents false activations of the SGD when the transparent panel inadvertently is subject to pressure. Each of the icons on the display of the SGD is a capacitive switch, which is activated by the capacitance of the user's body rather than
by pressure against the screen. One particular example of a touch screen for use in accordance with the subject SGD corresponds to a capacitive touch screen such as offered for sale by Touch International of Austin, Texas.

[0068] When employed in accordance with an aspect of the present invention, the incorporation of projective capacitive technology into a dedicated speech generating device has several advantages, especially relative to a typical resistive touch panel. A primary advantage stems from the fact that active sensing material can be applied to the back of any transparent material, in this case a super thin (0.043") chemically strengthened glass. The overall thinness and light weight are crucial in a lightweight, handheld ambulatory design. The top glass surface can be sealed to a bezel associated with a front casing component, providing ingress protection to moisture and dirt as well as a flush mounting surface so there is no recess for debris or liquids to accumulate. The active electronics and graphics are applied to the back surface of the glass which makes the top scratch resistant and increases the durability of the panel. High resolution devices are generally available, such as on the order of 10,000 dpi (dots per square inch). Capacitive touch screens also don't typically require recalibrations, as may be needed with resistive or pressure-sensitive touch screens.

[0069] Capacitive touch screens also provide advantages for conventional users of a speech generation device. A capacitive touch panel requires no activation force but only a slight contact, which is an advantage for a user who may have motor control limitations. Typical resistive sensors have a predetermined activation force required to physically short two conductive layers together. These top layers are external and can suffer failure due to scratching or physical breakdown of the spacing layer that separates the two conductive surfaces. Capacitive touch screens also accommodate multi-touch applications (i.e., a set of interaction techniques which allow a user to control graphical applications with several fingers) as well as scrolling.

[0070] In general, the different types of input devices (including optional peripheral devices) are configured with software instructions to accept user inputs in accordance with one or more access methods, including the following: a "Touch Enter", "Touch Exit", "Touch Auto Zoom", "Scanning", "Joystick", "Audio Touch", "Mouse Pause/Headtrackers", "Morse Code" and/or "Eye Tracking" access methods. In a "Touch Enter" access method, selection is made upon contact with the touch screen, with highlight and bold options to visually indicate selection. In a "Touch Exit" method, selection is made upon release as a user moves from selection to selection by dragging.
a finger as a stylus across the screen. In a "Touch Auto Zoom" method, a portion of the screen that was selected is automatically enlarged for better visual recognition by a user. In a "Scanning" mode, highlighting is used in a specific pattern so that individuals can use a switch (or other device) to make a selection when the desired object is highlighted. Selection can be made with a variety of customization options such as a 1-switch autoscan, 2-switch directed scan, 2-switch directed scan, 1-switch directed scan with dwell, inverse scanning, and auditory scanning. In a "Joystick" mode, selection is made with a button on the joystick, which is used as a pointer and moved around the touch screen. Users can receive audio feedback while navigating with the joystick. In an "Audio Touch" mode, the speed of directed selection is combined with auditory cues used in the "Scanning" mode. In the "Mouse Pause/Headtrackers" mode, selection is made by pausing on an object for a specified amount of time with a computer mouse or track ball that moves the cursor on the touch screen. An external switch exists for individuals who have the physical ability to direct a cursor with a mouse, but cannot press down on the mouse button to make selections. A "Morse Code" option is used to support one or two switches with visual and audio feedback. In "Eye Tracking" modes, selections are made simply by gazing at the device screen when outfitted with eye controller features and implementing selection based on dwell time, eye blinking or external switch activation.

[0071] SGD hardware components may also include one or more integrated output devices communicatively coupled to the central processing unit, such as but not limited to a display device 712 and speakers 714. Display device 712 may correspond to a suitable monitor, screen or other output device for visual presentation of to a user. Suitable examples, include but are not limited to a light-emitting diode (LED) display, electroluminescent display (ELD), plasma display panel (PDP), and liquid crystal display (LCD). One particular embodiment corresponds to an LCD such as an LW500AC9001 component offered for sale by Chi Mei Optoelectronics (CMO) of Taiwan. Speakers 714 may generally correspond to any compact high power audio output device, for example, a GC0401 low profile paper and mylar speaker such as offered for sale by Amaoto Industrial Co., Ltd. (A.I.C.) of Taiwan.

[0072] Speakers 714 may function as an audible interface for the speech generation device when computer processor(s) 702 utilize text-to-speech functionality. In accordance with general functionality of a speech generation device, a user provides text, symbols corresponding to text, and/or related or additional information in a
"Message Window" which may then be interpreted by a text-to-speech engine and provided as audio output via the speakers 714. In one embodiment, The SGD also includes an e-book reader that can be controlled by the user to read the e-book and have the e-book speak the words being read to the user. Speech output may be generated in accordance with one or more preconfigured text-to-speech generation tools in male or female and adult or child voices, such as but not limited to such products as offered for sale by Cepstral, HQ Voices offered by Acapela, Flexvoice offered by Mindmaker, DECtalk offered by Fonix, Loquendo products, VoiceText offered by NeoSpeech, products by, AT&T's Natural Voices offered by Wizzard, Microsoft Voices, digitized voice (digitally recorded voice clips) or others. A volume control module 722 may be controlled by one or more scrolling switches or touch-screen buttons.

SGD hardware components may also include various communications devices and/or modules, such as but not limited to an antenna 715, cellular phone or RF device 716 and wireless network adapter 718. Antenna 715 can support one or more of a variety of RF communications protocols. A cellular phone or other RF device 716 may be provided to enable the user to make phone calls directly and speak during the phone conversation using the SGD, thereby eliminating the need for a separate telephone device. A wireless network adapter 718 may be provided to enable access to a network, such as but not limited to a dial-in network, a local area network (LAN), wide area network (WAN), public switched telephone network (PSTN), the Internet, intranet or ethernet type networks or others. These communications modules (or others, such as but not limited to an infrared (IR) transceiver) may be provided to function as a universal remote control for the SGD that can operate devices in the user's environment, for example including TV, DVD player, and CD player.

When different wireless communication devices are included within an SGD, a dedicated communications interface module 720 may be provided within central computing device 700 to provide a software interface from the processing components of computer 700 to the communication device(s). In one embodiment, communications interface module 720 includes computer instructions stored on a computer-readable medium as previously described that instruct the communications devices how to send and receive communicated wireless or data signals.

Antenna 715 may be provided to facilitate wireless communications with other devices in accordance with one or more wireless communications protocols, including
but not limited to BLUETOOTH, WI-FI (802.11 b/g) and ZIGBEE wireless communication protocols. In one example, the antenna 715 enables a user to use the SGD with a BLUETOOTH headset for making phone calls or otherwise providing audio input to the SGD. The SGD can also generate BLUETOOTH radio signals that can be used to control a desktop computer, which appears on the SGD's display as a mouse and keyboard. An example of a suitable antenna for such devices is a surface mount Rufa brand antenna such as offered for sale by Antenova Ltd. of Cambridge, United Kingdom.

[0076] When the hardware components within an SGD embodiment, particularly the communications interface module 720, includes functional features by which the SGD can function as a Bluetooth radio, users can utilize the flexible input methods and software configurations of an SGD to control and operate a separate desktop or laptop computer. In such a fashion, the SGD appears to the desktop as a Human Interface Device (HID) device which allows the user who may not otherwise be able to type or control a mouse to operate the computer by taking advantage of the accessibility options provided by the SGD and its specialized hardware and software features. To access and control a personal computer using the Bluetooth features internal to the SGD, a user plugs a Bluetooth access control module into a USB port on the user's personal computer and performs a communication pairing procedure that establishes short-range wireless communication connectivity between the SGD and the personal computer. Similar steps may be followed to establish Bluetooth connections between an SGD and Bluetooth-enabled headset of keyboard/mouse, etc.

[0077] In addition to controlling a desktop, integrated Bluetooth features afford a user the opportunity to take advantage of several optional Bluetooth accessories. For example, a switch may be provided for users to mechanically actuate a selection on the SGD and then communicate that selection via Bluetooth protocols. Switching is often used when an SGD operates in a user-input mode where choices are scanned across the display as visual options or sequenced within an audio output and a user can then select one of the scanned options upon selection by switch. Scanning users often rely on switches located wherever the user has consistent and reliable motor control. Switches may be located on a head rest, seat, leg support, etc. Many conventional switches are hard-wired and include cables that are routed from the device around a wheelchair or other mounting location to the accessibility points. Provision of a Bluetooth-communicating input switch eliminates the potential for wire tangling, thus
providing a more convenient and safer environment for the user in a wheelchair with moving parts.

Another option afforded by Bluetooth communications features involves the benefits of a Bluetooth audio pathway. Many users utilize an option of auditory scanning to operate their SGD. A user can choose to use a Bluetooth-enabled headphone to listen to the scanning, thus affording a more private listening environment that eliminates or reduces potential disturbance in a classroom environment without public broadcasting of a user's communications. A Bluetooth (or other wirelessly configured headset) can provide advantages over traditional wired headsets, again by overcoming the cumbersome nature of the traditional headsets and their associated wires.

Fig. 24 shows an exemplary user interface menu provided via software features of the present invention that provides specific functional selection mechanisms for a user to implement Bluetooth functionality. The Bluetooth menu shown in Fig. 24 may include a variety of features, including a Bluetooth devices viewport 2400, an Unpair Bluetooth device button 2402, a Refresh button 2404, a locator button 2406, a Bluetooth device power button 2408, a device details group box 2410, a connect/disconnect button 2412 and a flash button 2414. Bluetooth devices viewport 2400 displays icons for all Bluetooth-enabled devices to which an SGD is currently connected, paired to, or that are available for connection. Unpair Bluetooth device button 2402 breaks the Bluetooth connection between an SGD and the Bluetooth-enabled device selected in the viewport. In other words, button 2402 unpairs a device and removes the device's icon from the viewport. Refresh button 2404 starts a new search for available Bluetooth-enabled devices. Locator button 2406 is selected if the Bluetooth-enabled device to which a user wants to connect is not displayed in the viewport 2400. Actuation of button 2406 opens a dialog box instructing the user to ready the device for pairing and then triggers a new search for available Bluetooth-enabled devices. Bluetooth device power button 2408 toggles the Bluetooth radio in the SGD on and off to enable or disable all Bluetooth connections between the SGD and Bluetooth-enabled devices. Device details group box 2410 lists details of the Bluetooth-enabled device selected in viewport 2400. Connect/disconnect button 2412 toggles between enabling and disabling a Bluetooth connection with the specific device selected in the viewport 2400. Flash button 2414 causes the Bluetooth access control module
plugged into a USB port of the Bluetooth device to flash an indicator light so that the Bluetooth connection can be verified.

[0080] When an exemplary SGD embodiment includes an integrated cell phone, a user is able to send and receive wireless phone calls and text messages. The cell phone component 716 shown in Fig. 7 may include an access port for a subscriber identity module (SIM) card by which a user can provide requisite information for identifying user information and cellular service provider, contact numbers, and other data for cellular phone use. In addition, associated data storage within the SGD itself can maintain a list of frequently-contacted phone numbers and individuals as well as a phone history or phone call and text messages. One or more memory devices or databases within a speech generation device may correspond to computer-readable medium that may include computer-executable instructions for performing various steps/tasks associated with a cellular phone and for providing related graphical user interface menus to a user for initiating the execution of such tasks. The input data received from a user via such graphical user interfaces can then be transformed into a visual display or audio output that depicts various information to a user regarding the phone call, such as the contact information, call status and/or other identifying information. General icons available on SGD or displays provided by the SGD can offer access points for quick access to the cell phone menus and functionality, as well as information about the integrated cell phone such as the cellular phone signal strength, battery life and the like.

[0081] Examples of features variously provided for a user in relation to the use of an integrated cell phone within a speech generation device are now discussed with reference to Figs. 8-11. It should be further appreciated that in addition to the software features described herein, specific hardware features included within a cellular phone may also be provided, such as but not limited to an RF transceiver module, coder/decoder (CODEC) module, digital signal processor (DSP) module, communications interfaces, microcontroller(s) and/or subscriber identity module (SIM) cards. It should be appreciated that all graphical user interfaces and menus that display "buttons" or other features that are selectable by a user correspond to user input features that when selected trigger control signals being sent to the central computing device within an SGD to perform an action in accordance with the selection of the user buttons.
Referring now to Fig. 8, an exemplary graphical user interface menu provided via software features of the present invention provides for an exemplary phone contacts menu for use with a cellular phone integrated with a speech generation device. A contact list can contain identifying information (e.g., address, phone number(s), e-mail address(es), etc.) for people in one or more groups such as family, friends, physicians, clinicians, or others. Once a contact list is established, a user can selectively employ the contact information to streamline cell phone, text messaging and e-mail communication activities via the SGD. As shown in Fig. 8, the exemplary contacts menu can include the following items: a contacts viewport 800, contact symbol display 801, contacts add button 802, contacts edit button 804, contacts delete button 806, contacts search button 808, contacts place call or send text button 810, or others. The contacts viewport generally displays the particular information about a contact as stored in computer-readable memory associated with the SGD. For example, contacts viewport 800 may display each contact in a user's list, including the phone number(s), e-mail address(es), and a predetermined or selected symbol. A larger version of the contact symbol is provided as display 801, to the right of the viewport 800. Contacts add button 802 is provided for selection by a user in order to add a new contact to the contact list. Contacts edit button 804 is provided for selection by a user in order to revise a currently selected contact. Contacts delete button 806 is provided for selection by a user in order to remove the currently selected contact. Contacts search button 808 is provided for selection by a user in order to search through the contact list using first or last name. Button 810 is provided for a user to place a call or send a text message to one of the numbers for the currently selected contact.

Before a user can use the contacts menu shown in Fig. 8, a user first provides general contact information about a user. An example of the user interface menu for providing initial or subsequent edits for a particular contact is shown in Fig. 9. The edit contact menu of Fig. 9 can be accessed and then opened to enter information for the new contact or to edit information for an existing contact. As shown in Fig. 9, contact information may selectively include one or more of the following: name, address, specifically designated ringtone, personalized custom greeting, home phone number, work phone number, cellular phone number, one or more e-mail addresses, and the like. A picture may also be selected by a user to provide a symbol corresponding to a visual reference for a particular contact.
Referring now to Fig. 10, a phone menu enables a user to dial outgoing phone calls, access the contacts list and view calling history. In particular, a standard 12-button number pad 1000 is provided by which a user can manually dial a phone number to which an outgoing phone call may be placed. A power button 1002 may be used to turn the integrated cell phone on or off. Turning the phone off can extend battery life when the user is not using the integrated phone feature. A hide button 1004 can minimize the phone menu so a user can navigate through the communication pages while the phone is active. A close button 1006 closes the phone menu, thus disconnecting any active phone calls. A viewport 1008 displays the phone number that a user is calling. A dial button 1010 enables a user to place an outgoing call to the number shown in the viewport. A backspace button 1012 enables a user to erase the last number in the viewport. A clear button 1014 enables a user to clear all numbers from the viewport. A contacts button 1016 enables a user to open the contacts menu (e.g., as shown in Fig. 8) to search through the user's list of contacts. A view call history button 1018 enables a user to display records of all incoming and outgoing phone calls.

To make an outgoing phone call, a user can select the dial button 1010 available on the phone menu of Fig. 10. Alternatively, a user can use the place call button 810 available from the contacts menu of Fig. 8. Still further, a user may have programmed a customized button on the SGD to perform the Dial Cell Phone action. Further selection of a programmed "Speak" button can be used to select a message window with content in it so that a user can use the SGD to "speak" the user's message through the integrated cell phone. Similar features can be used to answer an incoming call. In one example, a user will receive an incoming call via the integrated cell phone feature causing the SGD to ring like a telephone. An alert box may also be shown on the SGD's display device with information such as the incoming call name and number and selectable input buttons for the user to select either to answer or ignore the incoming call. If the incoming call is from an entity listed in the user's contacts menu, then the contact's symbol may also be provided within an incoming call alert box.

Referring now to Fig. 11, a text messaging menu enables a user to send a text message and to review the history of all or selected text messages that a user has sent and received. In particular, a viewport 1100 enables a user to select from a variety of tabs (Unread, Read, Sent, Drafts or Recent) to display a category of text messages in the viewport. Once messages are shown, buttons displayed to the right of viewport
1100 (e.g., View button 1102, Delete button 1104, and Delete All button 1106) will become available to help a user manage the text messages within each tab. A number field 1108 enables a user to send a text message to the number shown in the number field 1108. A text field 1110 visually displays to a user the body of a text message as it is entered. A contact button 1112 provides access to the current contact's numbers. If no contact is selected, the contact button 1112 enables a user to select a contact from available contacts. A send message button 1114 enables a user to send the created text message.

[0087] To send a text message (via SMS or other protocol), a user may have a variety of options. For example, a user can create a new text message by opening the text messaging menu of Fig. 11, entering the text message manually and either entering the phone number manually or finding a contact number using the contacts button. A user may alternatively send a quick text message by sending the current contents of a message window as a text message to a specific phone number. In this fashion, a user will be prompted to enter the phone number when the user selects the quick text programmed button. A user can also enter the phone number manually or select a number from the contacts menu to send a quick text message.

[0088] As previously mentioned, an exemplary SGD embodiment may also include features for connecting to the Internet, for example features including a wireless network adapter 718 such as shown in Fig. 7 or other communications module. Additional executable instructions stored in memory associated with central computing device provide a web browser to serve as a graphical user interface for interacting with the Internet. For example, software instructions may be provide to call preconfigured web browsers such as Microsoft Internet Explorer or Firefox® internet browser 30d available from Mozilla software.

[0089] Examples of menus and features related to SGD Internet access are now discussed with reference to Figs. 12-15. In general, such menus and features allow a user to not only achieve access to the Internet for customary purposes, but also to utilize information accessed via the Internet to further enhance the functionality of an SGD. For example, an SGD web browser can be provided to enable the user to go to a webpage and extract key vocabulary from that web page to use the extracted vocabulary so that the user can talk about current events or more sophisticated topics than is currently within the capability of the vocabulary of conventional SGDs. The SGD can also upgrade its own software by connecting to the internet and enabling the vendor.
of the SGD to update the SGD's software from the vendor's dedicated servers. Again, it should be appreciated that all graphical user interfaces and menus that display "buttons" or other features that are selectable by a user correspond to user input features that when selected trigger control signals being sent to the central computing device within an SGD to perform an action in accordance with the selection of the user buttons.

[0090] Referring again to the drawings, a specially designed web browser for use with exemplary SGD embodiments of the present invention is shown in Fig. 12. A set 1201 of go back/forward buttons enables a user to move backwards or forwards by one or more previously selected pages through the web browsing history. A reload current page button 1202 refreshes the current web page. A stop loading this page button 1203 is selected to provide an instruction to stop loading the current web page. A home button 1204 enables a user to open up the web page that the user has designated as a "Home" page. A Zoom in button 1205 enables a user to increase the font size of the current web page. A zoom out button 1206 enables a user to decrease the font size of the current web page. A reset button 1207 enables a user to return the font size on the current web page to standard or default size. An address text button 1208 enables a user to select this text box to enter a URL (web page address) that the user wants to open. When the address button 1208 is selected, such action may open up the system keyboard so that a user can enter the URL (web address) for the page the user wants to visit. A search text box button 1209 is selectable by a user to enter a keyword to use a search engine (e.g., Google, Yahoo, or other preconfigured searching tool available via the Internet) to search on the keyword. A Grab and Drag mode button 1210 enables a user to toggle the "grab and drag" setting in a web browser, such as may enable a user to select text and "flick" the screen to scroll up or down.

[0091] Referring now to Fig. 13, interface menus may be provided that enable a user to incorporate key words located on the Internet (i.e., "web words") into a user-customized vocabulary list. Such identified web words may then be incorporated into a user's custom message by selecting such words from a vocabulary list. In order to perform such word incorporation feature, a user may first enable the wireless network connection (e.g., Wi-Fi connection) available via the SGD, launch a provided web browser (e.g., MOZILLA FIREFOX) and navigate to a web page that includes the words of interest. On the page of interest, a user can select one or more portions of interest (e.g., the highlighted text box shown in Fig. 13). Upon selection of text, a text menu
1300 and possible sub-menu 1310 are provided, for example as also shown in Fig. 13. Such menus may be provided automatically (e.g., via pop-up window upon selection) or by selecting a button after the text has been selected by a user. Various options available from the text menu 1300 include a selectable "speak text" feature that instructs an SGD to immediately speak the selected text. Another feature is a "send to message window" feature that sends the selected text to a message window where additional actions can be selected. An "add vocabulary list as one item" feature enables a user to add the selected text to a vocabulary list as a single block. An "add to vocabulary list as multiple items" feature enables a user to add the selected text to a vocabulary list as individual words or phrases. When either of the options are selected from menu 1300 to add the text to a vocabulary list, a sub-menu 1310 may appear, listing all of the existing vocabulary lists available to a user that are enabled to accept web content. The specific vocabulary list desired by a user may then be selected. Selection may include a previously configured list or a new list.

[0092] Once web words have been selected and added to a vocabulary list, a user may view the words in a vocabulary list box, for example, as shown in Fig. 14. When a word is selected from the vocabulary list box, an SGD may be configured to either speak the word immediately or add the selected word into a message window, or both. Additional details regarding vocabulary list boxes and related features are presented below.

[0093] A still further internet-related feature available via an SGD corresponds to a user interface for importing symbols from the Internet. In general, such feature enables a user to select a picture available from an authorized source on a web page and import it into a custom symbol set for use by the user. In general, authorized sources include sources whose pictures and symbols are owned by the user, sources with pictures and symbols which the user has permission to use and access, and sources who provide pictures and symbols in the public domain. In order to perform such symbol incorporation feature, a user may first enable the wireless network connection (e.g., Wi-Fi connection) available via the SGD, launch a provided web browser (e.g., Mozilla Firefox) and navigate to a web page that includes the picture(s) or graphic(s) of interest. On the page of interest, a user can select the picture or graphic to initiate the display of a web symbol menu 1500 as shown in Fig. 15. An "add to my symbols" feature saves the picture with an automatically generated name. An "add to my symbols with name" feature prompts the user to enter a unique and meaningful name for the symbol and
then saves it to the SGD symbol library. The imported symbol is now available to use
as background on a page or a popup, as a symbol on a user button, or in another
interactive fashion.

[0094] Referring now to Fig. 16, exemplary steps performed in a software algorithm
for creating web words is presented. In general, integrated web access for vocabulary
generation in a speech generating device affords a method to select content from the
web, automatically extract useful terms and phrases, and use them immediately in
aided communication. In particular, software steps to perform such a method are stored
as executable instructions in a computer-readable medium such as previously
described. Execution of the steps is selectively activated by a user based on the user’s
selection of text and options available via menus, such as those illustrated in Figs. 13,
14 and 15.

[0095] In a first step 1600, electronic input is received indicating a vocabulary source
accessed by the user. The vocabulary source may correspond, for example, to text
available from a document, web page or other data source. It should be appreciated
that information available from the Internet may greatly expand the potential type and
amount of information that is available to a user as words that can be integrated into
messages and either spoken or communicatively transmitted via a speech generation
device. For example, extraction of useful web words may facilitate rapid communication
about presently relevant information, including current events, news stories, sports
stories, and/or information of a specific technical nature with specialized terminology.
The web serves as the source of vocabulary augmenting the information typically
delivered with a communication device, such as the names of people, places,
businesses, sports teams, etc.

[0096] Users can use the integrated web browser to find information related to that
which the user wants to communicate about. Electronic input is received by an SGD in
step 1602 indicating selected text from which to extract useful vocabulary. The user
may collect one or more pieces of such text, and provide input to the SGD that tags
selected pieces or each piece in step 1604 with a user-defined tag indicating a general
category of interest, separating the text into tagged buckets. In step 1606, each such
text bucket may be separately analyzed to determine words and phrases of interest, as
described in more detail below. The words and phrases are then made available for
use in communication in a scrolling view that presents the words and phrases. The
words and phrases may be augmented in step 1608 with a picture if a suitable picture is
found in an internal database whose label matches the word or phrase. Once terms have been discovered and offered to the user in the scrolling view described above, the user may select the individual items to be spoken. Alternatively, they may select the items to be inserted into a document, which may or may not be spoken.

[0097] Discovered vocabulary may also be used in other ways once it has been discovered. For example, the lists of discovered vocabulary may be added to a permanent internal database of vocabulary available to the user at all times. One use of the vocabulary lists is with the slot mechanism described below. The lists of discovered vocabulary may serve as source material for constructing more traditional communication pages. Vocabulary items can be directly selected and inserted onto buttons on communication pages, along with any matching symbols. Discovered vocabulary may be entered into an internal dictionary and used to augment word prediction. The discovered words will become part of the database of words that get predicted in response to partial inputs.

[0098] The text bucket analysis of step 1606 may include a variety of specific software-based rules. For example, selected text may be examined to discover interesting new words and phrases by extracting various identified items: Any new word not in an SGD's internal dictionary; Any noun, adjective, or verb from an internal dictionary that has a frequency of occurrence rating below some threshold; Phrases consisting of adjacent words from the text that contain either interesting words (by the above definitions) or capitalized words. All such words and/or phrases, up to a threshold length, are extracted from the text. Any such phrases that occur more than some threshold number of times in the text are added to the list of extracted words and phrases.

[0099] In addition to vocabulary discovery, other types of media encountered while traversing the web with an SGD's integrated browser can be integrated with the communication device's internal data library. Images encountered on communication pages can be selected and directly incorporated into the internal symbol database of the communication device user. Similarly, video and audio files encountered can also be added to the internal media databases for use by the communication device user. Audio samples will often be used to augment synthesized text-to-speech for communication and video samples can serve as a means of shared communication experience and to ground communication between a device user and the user's communication recipient(s).
[00100] Words, phrases, symbols and other information either stored on a SGD or imported as described above can be grouped and used in preconfigured or customized compilations referred to herein as vocabulary lists or vocabulary list boxes. Vocabulary list boxes enable a user to have a wide variety of words and phrases immediately available. By listing groups of related words and phrases, vocabulary list boxes enable a user to quickly search through a wide range of text options when composing a message. For example, a user can select a particular group of words and/or phrases and associate all selected items into a new vocabulary list, which may be named and optionally assigned a unique symbol to visually represent the vocabulary list. Setting options characterizing each vocabulary list may also be defined, for example, an indication of whether the vocabulary list should accept new words and phrases from sources available on the Internet. Once a vocabulary list is made, new words or phrases can be added to the vocabulary list and/or existing words or phrases may be edited or deleted. Features may also be provided such that existing vocabulary lists can be embedded into other vocabulary lists, thus providing a hierarchy of related sets and subsets of vocabulary lists. Features may be provided to add vocabulary searches into a vocabulary list or to sort and display the contents of a vocabulary list according to selected parameters such as alphabetization and frequency of use in messages. Features may also be provided to trigger actions performed by the SGD upon selection of an item from a vocabulary list, for example, to automatically "speak" or provide as audio output the words/phrases from a vocabulary list box immediately as it is selected by a user, or to send the words/phrases from the vocabulary list box to the Message Window as it is selected by a user.

[00101] When embedding one vocabulary list in another, a user can get better access to more specific vocabulary on a related subject. For example, as shown in Fig. 17, software instructions may be configured to display an embedded vocabulary list in a similar fashion (i.e., as an icon) as any other item in a given vocabulary list box. The example in Fig. 17 shows a user interface displaying a vocabulary list box with the vocabulary list "Animals" having the "Animal Sounds" vocabulary list embedded within it. When an embedded vocabulary list is selected by a user, its contents will then be displayed in the vocabulary list box. All the words in the original vocabulary list "Animals" (e.g., aardvark, alligator, animal, ant, anteater, antelope, ape, armadillo, etc.) as well as the words in the embedded vocabulary list "Animal Sounds" (e.g., bark, bleat,
buzz, chirp, cluck, croak, gobble, growl, hiss, etc.) are then available for a user to use in a message.

When embedding a vocabulary search within a vocabulary list, a search for words and phrases will automatically scan through a dictionary of words and phrases provided on the SGD and display all words and phrases that meet the user-defined search criteria. For example, suppose that a user adds twelve words to an SGD dictionary and marks them all with the "Clothing" category. The next time a user opens a page with a vocabulary list containing a vocabulary search on "Clothing", those twelve new words will automatically appear in the vocabulary list box. By inserting a search itself to a vocabulary list, a search can be performed dynamically. As such, when other items are added to a dictionary that matches a user's search criteria, a user does not have to go back and separately add the new words to different preexisting vocabulary lists. The results of an embedded vocabulary search can be intermixed with the other vocabulary items within the vocabulary list. They will appear side by side with the individual vocabulary items, and they can be sorted based on the settings of the vocabulary list box (alphabetically, as is, or by frequency of use).

The SGD may further include executable instructions stored on a computer-readable medium that implement a unique method of communication rate enhancement that combines sentences and phrases with slot fillers. In general, implementation of a "slots" feature triggers software provision of mechanisms to insert a "slot" or placeholder in a text phrase. Each one of these placeholders is associated with a list of "fillers" that can potentially fill in this place in the text. The list of slots and their associated fillers are stored in a database internal to the software. When a user inserts the text containing the slot into a document, the slot position is filled with a default filler, and that filler is underlined in the text. The user then may select this underlined word, and upon the user's selection of the underlined word, the user is presented with the entire list of fillers for that slot and may choose another filler, at which point that filler is inserted in that place in the text, which remains underlined so that the filler may be changed again in the future. Another variation on the slots protocol allows a user to declare to speak a text phrase containing one or more fillers. At which point the user is prompted to specify the filler values for each slot, and then the entire text phrase, with the filler values chosen by the user, is spoken. Slot fillers can optionally have pictures associated with them in which case those pictures can be used to augment the display
of the filler value. Slots can be added and deleted by the user, and filler values can also be added and deleted by the user.

[00104] The slots can be populated with literal terms, words or phrases, vocabulary lists and related features as described above, embedded searches and/or embedded recursive slots. Moreover, this unique method optionally can be combined with symbols. A "slot" placeholder can also be included in button text, button labels and phrases. Specific interface options may be provided for a user to create a phrase with slots, adding slots to buttons, and work with slots in a Message Window. The capability embodied in the so-called "slots" protocol provides the user with the ability to fill in certain words in otherwise static text. The slots protocol provides the user with easy access to common words that can be used to complete a message in a variety of settings and situations. For example, in the phrase: "Can we have dinner now?", the slot is "dinner". Other commonly-used words like "breakfast" or "coffee" are slots that can be used interchangeably to complete similar messages like: "Can we have breakfast now?". Slots are additional tools that minimize necessary navigation to save the user's time and energy during message composition.

[00105] In general, slots are designed to provide a variety of vocabulary options while reducing the number of selections that a user must make to create a whole message. Slots also help to conserve space on the touch screen. Slots provide a user with easy access to all of the words associated with a particular vocabulary concept (or category). When a user selects a slot, the user can choose to replace the word that is currently filling the slot with another word from the same concept. Rather than build a dynamic message one word at a time, a user can create sentences that contain slots in key locations. When the phrase is added to the Message Window, a user can then select the slots (which are visually indicated in some fashion, for example displayed as blue underlined words) and replace the current words with different options.

[00106] Referring to the following example of Figs. 18 and 19, the message in the Message Window is the label text for a button. The first slot is associated with the "breakfast" concept and the second slot is associated with the "fruit" concept. The slots allow a user to create dynamic messages with a reduced number of selections. By selecting the slots and changing the filler text, the example phrase "I want oatmeal and a banana for breakfast" can quickly and easily be changed to read as follows: "I want toast and a nectarine for breakfast".
In accordance with the concepts slot technology, a user may be able to add slots to his customized phrase database - My Phrases. Adding slots to phrases is one way to maximize the potential of both a slot/filler rate enhancement feature as well as a phrase prediction rate enhancement feature. This technique provides a user with rapid access to complete statements, while still enabling the user to vary what he is going to say. For example, if a user tells an assistant what he wants to wear every morning, then he may want to create a phrase to say "I want to wear my jeans today." Then, simply turn the word "jeans" into a slot that accesses the "clothing" concept. Every morning the user can quickly access the same phrase, no matter what page or popup is active, and say "I want to wear my sweater today." or "I want to wear my boots today." A user could even add more slots, such as one that accesses the "colors" concept or the "textures" concept to add more description to such statements.

In accordance with phrase prediction rate enhancement functionality, one or more areas of a user display (i.e., buttons) can be filled with phrases as a user enters text into a document. For example, as a user enters text, the SGD can match the partially entered text to an internal database of text phrases and present those phrases whose starting characteristics match the partially entered text. Each phrase may also be assigned a priority rating (e.g., based on frequency of use or other characterizing feature). In the case where more phrases are found that match the partially entered text than there are buttons to fill, those phrases with the highest priority ratings are shown. The phrase database can be added to or deleted from by a user. Phrases may optionally have pictures associated with them in which case those pictures can be used to augment the display of the phrases on the buttons. Phrases may also contain slots with their associated fillers.

A still further feature that may be provided in exemplary embodiments of a speech generation device corresponds to a voice inflection mark up feature that can add inflection to the speech output of the SGD. Thus, the speech output not only can be controlled as to the volume of the spoken words, as to the pitch of the voice (childlike, female, masculine), but also individual syllables can be differently emphasized to convey different emotions and different voices that communicate different meanings just based on the different inflections imposed on different syllables of the words being spoken by the SGD. This feature overcomes limitations of the kinds of standard language that is employed by most conventional SGDs.
Fig. 20 illustrates exemplary steps that may be performed in a method of implementing speech characterizations such as speech styles and/or speech effects. In step 2010, an SGD receives input from a user associating one or more speech styles to selected text. In particular, a user can selectively mark text that the user wants to be spoken with a specific stylistic variation and then apply the speech style, much like a user would apply a font style in a typical word processing application. User interface locations by which a user can apply these speech styles via actions can be embedded in user communication pages, making this feature available to all communication device users regardless of the user's physical disabilities or access needs. Input defining one or more associated speech styles can be embedded as markups directly in documents. As such, users can store their documents with stylistic variants for later recall and use. Once entered, a style markup can be selected and its properties modified.

Supported speech styles may include variations defined by the following non-exhaustive list of exemplary parameters: voice, volume, pitch, speech rate, spell mode, emphasis and context. When defining a speech style according to voice, a user can select the specific text-to-speech voice to use to speak the selected text. When defining a speech style according to volume, a user can select the specific volume at which to speak the selected text. When defining a speech style according to pitch, a user can select one or more specific pitch changes to apply to selected text. When defining a speech style according to speed at which to speak the selected text. When defining a speech style according to spell mode, the user can select to spell out the selected text rather than pronouncing it normally as a word - e.g., "H-E-L-L-O" instead of "Hello." When defining a speech style according to emphasis, a user can select the specific portions of text to emphasize in a spoken portion of text, for example by increasing the amount of voice inflection given to the emphasized text portions. When defining a speech style according to context, a user can define when to declare the context of a selected portion of speech, e.g., to speak the selected portion as if it were a date, currency, or other contextually appropriate format. An example of an interface menu that may be provided to a user for selecting speech styles is shown in Fig. 22.

Referring still to Fig. 20, input may also be received by an SGD associating one or more speech effects to selected text. It should be appreciated that although steps 2010 and 2012 are shown as separate and subsequent steps, steps 2010 and 2012 can actually occur intermixed in time and each can selectively occur
multiple times as desired by a user in a method of implementing voice inflection. Examples of speech effects may correspond, for example, to different emotional effects, non-verbal communication noises, etc. such as but not limited to coughing, laughing, crying, kissing, sniffing, swallowing, sighing, whistling, yawning, or making noises such as "eh", "oh", "mmm", etc. Again, features may be provided such that speech effects can be embedded in user communication pages. An example of an interface menu that may be provided to a user for selecting speech effects is shown in Fig. 23, where selections can be made for a desired speech effect to be entered into a message window or spoken immediately upon selection.

[0013] As input defining one or more speech styles and/or speech effects is received for a given portion of text, the marked up text may be displayed in a message window, for example as shown in Fig. 21. A first portion of text, "Hi Jim!" has been selected and associated with a speech style defining a selected level of volume. A second portion of text, "That's" has been selected and associated with a speech style indicating desired emphasis on this first word in the sentence. A speech effect, namely laughing, is inserted at the end of the given text to simulate a user's laugh. Such enhanced speech features provide a more interactive and enjoyable method of communicating for a user of a speech generation device.

[0014] After input defining one or more speech styles and/or speech effects is received for a given portion of text (e.g., text displayed in a message window), the marked-up text is relayed to an interpretation engine such that the marked text can be analyzed by software rules in step 2014 to determine an optimum speech-to-text engine for speaking the marked-up selected text and associated speech styles/effects. Because several different text-to-speech engines may be included with SGD software, such an interpretation engine may be configured to examine the graphical markup inclusions and target them for a specific text-to-speech engine, selecting the best match for a given speech style or effect and the underlying text-to-speech engine. Once the optimum text-to-speech engine is determined in step 2014, the actual text-to-speech spoken output may then be generated in step 2016.

[0015] While at least one presently preferred embodiment of the invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the present invention.
WHAT IS CLAIMED IS:

1. A speech generation device, comprising:
   a display device for displaying images to a viewer;
   a capacitive touch screen for capturing user inputs directed to the display device;
   and
   a processor communicatively coupled to the display device and the touch screen;
   a computer-readable medium storing instructions executable by the processor;
   and
   wherein the instructions stored on the computer-readable medium configure the
   speech generation device to generate text-to-speech output.

2. The speech generation device of claim 1, wherein the capacitive touch screen comprises a projective capacitive touch screen.

3. The speech generation device of claim 1, wherein the capacitive touch screen comprises a transparent panel covering the display device.

4. The speech generation device of claim 3, wherein an active sensing material of the capacitive touch screen is applied to a back surface of the transparent panel.

5. The speech generation device of claim 3, further comprising an outer housing, the outer housing being configured to accommodate the transparent panel, the display device being disposed within the outer housing such that visual access to the display pane! is provided through the transparent panel.

6. The speech generation device of claim 5, wherein a top surface of the transparent panel is sealed to a bezel associated with the outer housing.

7. A speech generation device, comprising:
   a display device for displaying images to a viewer;
   an integrated cellular phone device;
   a processor communicatively coupled to the display device and the integrated cellular phone device; and
   a computer-readable medium for storing instructions executable by the processor;
   wherein the instructions stored on the computer-readable medium configure the speech generation device to send and receive at least one of phone calls or text messages.
8. The speech generation device of claim 7, wherein the instructions stored on the computer-readable medium further configure the speech generation device to generate a contacts menu displaying identifying information of one or more contacts.

9. The speech generation device of claim 8, wherein the instructions stored on the computer-readable medium enable a user to place a call or send a text message by selecting a button on the contacts menu.

10. The speech generation device of claim 8, wherein the instructions stored on the computer-readable medium further configure the speech generation device to generate an edit contacts menu enabling a user to enter identifying information of a new contact or edit identifying information of an existing contact.

11. The speech generation device of claim 7, wherein the instructions stored on the computer-readable medium further configure the speech generation device to generate a phone menu enabling a user to perform at least one of dialing a phone number, accessing a contacts menu, viewing phone call history or turning off the integrated cellular phone device.

12. The speech generation device of claim 7, wherein the instructions stored on the computer-readable medium further configure the speech generation device to speak through the integrated cellular phone device.

13. The speech generation device of claim 7, wherein the instructions stored on the computer-readable medium further configure the speech generation device to display call information to a user relating to an incoming or outgoing call.

14. The speech generation device of claim 7, wherein the instructions stored on the computer-readable medium further configure the speech generation device to generate a text message menu enabling a user to perform at least one of sending a text message or viewing a history of received and sent text messages.

15. A speech generation device, comprising:
   a display device for displaying images to a viewer;
   at least one wireless communications device;
   a processor communicatively coupled to the display device and the at least one wireless communications device; and
   a computer-readable medium for storing instructions executable by the processor,
wherein the instructions stored on the computer-readable medium configure the speech generation device to wirelessly communicate with one or more secondary devices.

16. The speech generation device of claim 15, wherein the instructions stored on the computer-readable medium more particularly configure the speech generation device to wirelessly communicate with and control a secondary computer.

17. The speech generation device of claim 16, wherein the secondary computer comprises a desktop computer or a laptop computer.

18. The speech generation device of claim 16, wherein the secondary computer is displayed on the display device of the speech generation device as a mouse and keyboard.

19. The speech generation device of claim 15, wherein the one or more secondary devices comprises a wireless headset.

20. The speech generation device of claim 15, wherein the at least one wireless communications device comprises at least one antenna.

21. The speech generation device of claim 15, wherein the at least one wireless communication device comprises at least one infrared transceiver.

22. The speech generation device of claim 15, wherein the at least one wireless communication device comprises a wireless network adaptor for connecting to the internet.

23. The speech generation device of claim 15, wherein the instructions stored on the computer-readable medium configure the speech generation device to upgrade its instructions via the connection to the Internet provided by the wireless network adaptor.

24. The speech generation device of claim 15, wherein the one or more secondary devices comprise a wireless-communicating input switch.

25. The speech generation device of claim 24, wherein the instructions stored on the computer readable medium configure the speech generation device to scan visual options across the display device and to detect user actuation of the wireless-communicating input switch as selection of a scanned visual option.

26. The speech generation device of claim 15, wherein the instructions stored on the computer readable medium configure the speech generation device to perform a communications pairing procedure for the speech generation device and the one or more secondary devices.
27. A method of extracting internet-based content for use with a speech generation device, the method comprising:
establishing a connection between the speech generation device and the internet;
receiving an input indicating selected internet-based content from which to extract at least one type of media;
automatically extracting the at least one type of media for use with the speech generation device; and
incorporating the at least one type of media into a library or database stored on a computer-readable medium of the speech generation device.

28. The method of claim 27, wherein the at least one type of media comprises one or more of images, video files, audio files or web words.

29. The method of claim 27, further comprising one or more of speaking the at least one type of media as audio output or displaying the at least one type of media as visual output.

30. A speech generation device, comprising:
a display device for displaying images to a viewer;
a wireless network adaptor for providing access to a network;
a processor communicatively coupled to the display device and the wireless network adaptor; and
a computer-readable medium for storing instructions executable by the processor;

wherein the instructions stored on the computer-readable medium configure the speech generation device to implement the method of claim 27.

31. A method of extracting internet-based content for use with a speech generation device, the method comprising:
establishing a connection between the speech generation device and the internet;
receiving an input identifying selected text from which to extract vocabulary from an internet-based vocabulary source;
receiving an input identifying one or more pieces of the selected text to be analyzed; and
analyzing the one or more pieces of the selected text to determine words and phrases of interest.
32. The method of claim 31, wherein the words and phrases of interest comprise at least one interesting word, the at least one interesting word comprising any word not included in an internal dictionary of the speech generation device or any noun, adjective or verb included in an internal dictionary of the speech generation device which has a frequency of occurrence rating below a predetermined threshold.

33. The method of claim 32, wherein the words and phrases of interest further comprise any phrase including adjacent words from the one or more pieces of the selected text that contain capitalized words or the at least one interesting word.

34. The method of claim 31, wherein the words and phrases of interest comprise any phrase that occurs more than a threshold number of times within the one or more pieces of the selected text.

35. The method of claim 31, further comprising displaying the words and phrases of interest to a user for use in communication.

36. The method of claim 35, wherein the words and phrases of interest are displayed to the user in a scrolling view.

37. The method of claim 36, wherein the speech generation device is configured to generate a text-to-speech output when at least one of the words and phrases of interest is selected from the scrolling view.

38. The method of claim 36, wherein the speech generation device is configured to insert at least one of the words and phrases of interest into a document when the at least one of the words and phrases of interest is selected from the scrolling view.

39. The method of claim 31, further comprising adding the words and phrases of interest to one or more vocabulary lists stored on a computer-readable medium of the speech generation device.

40. The method of claim 31, further comprising adding the words and phrases of interest into an internal dictionary stored on a computer-readable medium of the speech generation device for use with word prediction.

41. The method of claim 31, further comprising receiving an input indicating access of an internet-based vocabulary source using an integrated web browser of the speech generation device.

42. The method of claim 31, further comprising augmenting the words and phrases of interest with identification information.
43. The method of claim 42, wherein the identification information comprises an image or symbol stored on a computer readable medium of the speech generation device.

44. A speech generation device, comprising:
   a display device for displaying images to a viewer;
   a wireless network adaptor for providing access to a network;
   a processor communicatively coupled to the display device and the wireless network adaptor; and
   a computer-readable medium for storing instructions executable by the processor;
   wherein the instructions stored on the computer-readable medium configure the speech generation device to implement the method of claim 31.

45. A hand-held speech generation device, comprising:
   an outer housing, the outer housing including a top casing component and a bottom casing component;
   first and second convex extensions extending from the bottom casing component, the first and second convex extensions being ergonomically configured to facilitate location and grip of a user's fingers; and
   a processor and related computer-readable medium for storing instructions executable by the processor, the processor and computer-readable medium being disposed in the outer housing;
   wherein the instructions stored on the computer-readable medium configure the speech generation device to generate text-to-speech output.

46. The hand-held speech generation device of claim 45, further comprising a speaker grille forming a front surface of the speech generation device.

47. The hand-held speech generation device of claim 46, wherein the first and second convex extensions extend along the bottom casing component from the speaker grille in a direction of a rear surface of the speech generation device.

48. The hand-held speech generation device of claim 47, wherein the first and second convex extensions taper in size from the speaker grille in the direction of the rear surface of the speech generation device.

49. The hand-held speech generation device of claim 45, further comprising first and second convexly shaped opposing sides, the first and second opposing sides being at least partially defined by the top and bottom casing components.
50. The hand-held speech generation device of claim 49, wherein the first and second opposing sides define a predetermined thickness, the predetermined thickness being configured such that the first and second opposing sides fit within the palms of a user's hands.

51. The hand-held speech generation device of claim 49, wherein the first convex extension is disposed substantially adjacent to the first opposing side and the second convex extension is disposed substantially adjacent to the second opposing side.

52. The hand-held speech generation device of claim 45, further comprising one or more printed circuit boards disposed within the outer housing, the one or more printed circuit boards being configured as structural components and providing a mounting surface for one or more internal components of the speech generation device.

53. The hand-held speech generation device of claim 45, wherein an upper peripheral surface of the top casing component is formed from a material selected to highlight an outer perimeter of the speech generation device.

54. The hand-held speech generation device of claim 53, wherein the material comprises chrome.

55. The hand-held speech generation device of claim 45, wherein the outer housing is formed from a substantially rigid and lightweight material.

56. The hand-held speech generation device of claim 55, wherein the substantially rigid and lightweight material comprises a plastic material, a thermoplastic material, a polymer material, a polyethylene material or a resin material.

57. The hand-held speech generation device of claim 45, wherein the outer housing is formed from magnesium or a magnesium alloy.

58. The hand-held speech generation device of claim 57, wherein the processor is thermally coupled to a portion of the outer housing.

59. The hand-held speech generation device of claim 45, wherein the outer housing is configured such that audio output from the speech generation device radiates outwardly from the user when the user properly positions his hands around the speech generation device.

60. The hand-held speech generation device of claim 45, wherein the top casing component defines an opening configured to provide visual access to a display panel of the speech generation device.
61. The hand-held speech generation device of claim 60, wherein the top casing component further defines a recessed area configured to accommodate a touch screen, the touch screen being transparent so as to permit the display panel to be viewed through the touch screen.

62. The hand-held speech generation device of claim 61, wherein the touch screen comprises a capacitive touch screen.

63. The hand-held speech generation device of claim 45, further comprising:
   a battery for powering the speech generation device;
   wherein the bottom casing component comprises first and second bottom casing components; and
   wherein the battery is stored between the first and second bottom casing components such that the second bottom casing component forms the bottommost surface of the outer housing.

64. The hand-held speech generation device of claim 45, wherein the first and second convex extensions each define a concavely shaped recessed area.

65. A method of implementing speech characterizations to the speech output of a speech generation device, the method comprising:
   receiving an input associating one or more speech characterizations to selected text;
   analyzing the selected text and the one or more associated speech characterizations to determine a text-to-speech engine for outputting the selected text and the one or more associated speech characterizations; and
   generating a text-to-speech output utilizing the determined text-to-speech engine.

66. The method of claim 65, wherein the one or more speech characterizations comprise at least one of speech styles or speech effects.

67. The method of claim 65, wherein the one or more speech characterizations comprise one or more speech styles, the one or more speech styles being defined by at least one of voice, volume, pitch, speech rate, spell mode, emphasis or context.

68. The method of claim 65, wherein the one or more speech characterizations comprise one or more speech effects, the one or more speech effects comprising at least one of an emotional effect or a non-verbal communication noise.
69. The method of claim 65, wherein the input associating the one or more speech characterizations to the selected text is embedded directly as an inflection markup of the selected text.

70. The method of claim 69, wherein the inflection markup corresponds to a speech style or speech effect to be applied to the selected text when generating the text-to-speech output.

71. The method of claim 69, wherein the inflection markup of the selected text is stored as a document in a computer readable medium of the speech generation device to permit the inflection markup to be subsequently recalled and modified.

72. The method of claim 69, wherein the inflection markup of the selected text is displayed in a message window of the speech generation device.

73. The method of claim 65, wherein the selected text and the one or more associated speech characterizations are analyzed by an interpretation engine.

74. The method of claim 73, wherein the interpretation engine is configured to examine the selected text and the one or more associated speech characterizations to determine an optimum text-to-speech engine for outputting the selected text and the one or more associated speech characterizations.

75. The method of claim 65, wherein a plurality of text-to-speech engines are stored as software instructions on a computer-readable medium of the speech generation device.

76. The method of claim 65, wherein the text-to-speech output is generated using one or more speakers of the speech generation device.

77. A speech generation device, comprising:
   a display device for displaying images to a viewer;
   one or more speakers for generating audio outputs;
   a processor communicatively coupled to the display device and the one or more speakers; and
   a computer-readable medium for storing instructions executable by the processor;
   wherein the instructions stored on the computer-readable medium configure the speech generation device to implement the method of claim 65.

78. A speech generation device, comprising
   an outer housing, at least a portion of the outer housing being formed from magnesium or a magnesium alloy; and
a processor and related computer-readable medium for storing instructions executable by the processor, the processor and computer-readable medium being disposed in the outer housing;

wherein the instructions stored on the computer-readable medium configure the speech generation device to generate text-to-speech output.

79. The speech generation device of claim 78, wherein the outer housing comprises a top casing component and a bottom casing component, the at least a portion of the outer housing comprising at least one of the top casing component or the bottom casing component.

80. The speech generation device of claim 79, further comprising:
   a battery for powering the speech generation device;
   wherein the bottom casing component comprises first and second bottom casing components; and
   wherein the battery is stored between the first and second bottom casing components such that the second bottom casing component forms the bottommost surface of the outer housing.

81. The speech generation device of claim 78, wherein the outer housing is formed from an injection molding process.

82. The speech generation device of claim 78, wherein the processor is thermally coupled to the at least a portion of the outer housing.
FIG. 8

FIG. 9
ACCESS VOCABULARY SOURCE

IDENTIFY TEXT OF INTEREST FROM VOCABULARY SOURCE

TAG IDENTIFIED TEXT TO INDICATE GENERAL CATEGORY(-IES) OF INTEREST, THUS FORMING TEXT BUCKETS

ANALYZE TEXT BUCKETS TO DETERMINE WORDS OR PHASES OF INTEREST

AUGMENT WORDS OR PHRASES OF INTEREST WITH ADDITIONAL IDENTIFICATION INFORMATION

FIG. 16

EMBEDDED VOCABULARY LIST (EXAMPLE)

FIG. 17
RECEIVE INPUT ASSOCIATING ONE OR MORE SPEECH STYLES TO SELECTED TEXT

RECEIVE INPUT ASSOCIATING ONE OR MORE SPEECH EFFECTS TO SELECTED TEXT

ANALYZE MARKED TEXT WITH INTERPRETATION ENGINE TO DETERMINE OPTIMUM TEXT-TO-SPEECH ENGINE

GENERATE TEXT-TO-SPEECH OUTPUT USING DETERMINED OPTIMUM TEXT-TO-SPEECH ENGINE

FIG. 20
**FIG. 23**

**SELECT SPEECH EFFECT**

- COUGH
- CRY
- EH
- KISS
- LAUGH
- MMM
- OH
- SNIFF
- SWALLOW
- THROAT
- WHISTLE
- YAWN

**FIG. 24**

**BLUETOOTH SETTINGS MENU**

**BLUETOOTH SETTINGS**

- 2402 2404 2400 2408

**DEVICE DETAILS**

- PROGRAM ACCESS/NOT CONNECTED

**CONNECT**

**FLASH**

**WHERE'S MY DEVICE?**

**TURN BLUETOOTH OFF**

**READY**
INTERNATIONAL SEARCH REPORT

INTERNATIONAL SEARCH REPORT

A CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G 10 L 13/08 (2010.01)  
USPC - 704/260

According to International Patent Classification (IPC) or to both national classification and IPC

B FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC 704/260

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC 704/260, 704/258, 261, 270, 271, 276, 905, E13 001, E13 005, E13 008, 16/430, 345/169, 173, 905, 715/864, 865, 379/52, 28 16, 917, 340/825 19, 707/769, 709/203, 218, 715/705, 747 (keyword limited - see search terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PUBWEST (PGP, USPT, USOC, EPAB, JPAB), GOOGLE, Google Scholar

Terms speech, generation, synthesis, text, display, touchscreen, capacitive, projector, bezel, frame, grip, hand, speaker, audio, portable, chrome, mobile, cellular, wireless, interface, menu, contact, address, list, history, log, message, sms, call, peripheral, device, input

C DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, the date of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 2008/0154601 A1 (Stifelman et al.) 26 June 2008 (26 06 2008), entire document, especially abstract, para [0009], [0012], [0043], [0046], [0049], [0054], [0055], [0057], [0072], [0097], [0116], [0145], [0657], [1202]</td>
<td>1-82</td>
</tr>
<tr>
<td>Y</td>
<td>US 2006/0284839 A1 (Breed et al.) 21 December 2006 (21 12 2006), entire document, especially abstract, FIG. 101, para [0007], [0019], [0188], [0354], [0366], [0367], [0379], [0423], [0541], [0565], [0568], [0583], [0586], [0589], [0586], [0597], [1031], [1154], [1162], [1174], [1179]</td>
<td>1-6, 45-64</td>
</tr>
<tr>
<td>Y</td>
<td>US 2007/0260460 A1 (Hyatt) 08 November 2007 (08 11 2007), entire document, especially abstract, para [0002], [0003], [0004], [0005], [0006], [0040], [0042], [0045], [0046], [0048], [0500], [0505], [0511], [0525], [0554], [0555], [0559], [0626], [0700], [0703], [0707], [0709], [0899]</td>
<td>7-44</td>
</tr>
<tr>
<td>Y</td>
<td>US 2009/063154 A1 (Gusikhin et al.) 05 March 2009 (05 03 2009), entire document, especially abstract, para [0031], [0032], [0039], [0040], [0061], [0089], [0090], [0125], [0139], [0140], [0154], [0159], [0191]</td>
<td>65-77</td>
</tr>
<tr>
<td>Y</td>
<td>US 2006/0169314 A1 (Inoue et al.) 03 August 2006 (03 08 2006), entire document, especially abstract, para [0008], [0009], [0035], [0039], [0060], [0062], [0063]</td>
<td>78-82</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C

D

Date of the actual completion of the international search
17 November 2010 (17 11 2010)

Date of mailing of the international search report
29 NQV 2010

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents  
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No 571-273-3201

Authorized officer
Lee W Young

PCT Helpdesk: 571-272-4300
PCTHelp: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 2003/0022701 A1 (Gupta) 30 January 2003 (30 01 2003), entire document, especially abstract, para [0004], [0034], [0025], [0026], [0036]</td>
<td>7-44</td>
</tr>
<tr>
<td>A</td>
<td>US 2006/0069567 A1 (Tischer et al) 30 March 2006 (30 03 2006), entire document, especially abstract, para [0004], [0005], [0041], [0048], [0053], [0055], [0059]</td>
<td>65-77</td>
</tr>
<tr>
<td>A</td>
<td>US 2007/0124144 A1 (Johnson) 31 May 2007 (31 05 2007), entire document, especially abstract, para [0027], [0028], [0031], [0463]</td>
<td>1-6, 45-64</td>
</tr>
</tbody>
</table>
**INTERNATIONAL SEARCH REPORT**

**Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. **Claims Nos** because they relate to subject matter not required to be searched by this Authority, namely

2. **Claims Nos** because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically

3. **Claims Nos** because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

**Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

- PLEASE SEE EXTRA SHEET -

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims, it is covered by claims Nos.</td>
<td></td>
</tr>
</tbody>
</table>

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)
INTERNATIONAL SEARCH REPORT

Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13 1 in order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I Claims 1-6, 45-64 - A hand-held speech generation device, comprising an outer housing, first and second convex extensions extending from the bottom casing component, the first and second convex extensions being ergonomically configured to facilitate location and grip of a user's fingers, configuring the speech generation device to generate text-to-speech output, the top casing component further defines a recessed area configured to accommodate a touch screen, the touch screen being transparent so as to permit the display panel to be viewed through the touch screen

Group II Claims 7-26 - A speech generation device, comprising a display device for displaying images to a viewer, an integrated cellular phone device, configuring the speech generation device to wirelessly communicate, and generating a menu options enabling a user to perform at least one of dialing a phone number, accessing a contacts menu, viewing phone call history, turning off the integrated cellular phone device or communicate with secondary devices

Group III Claims 27-44 - A method of extracting internet-based content for use with a speech generation device, the method comprising establishing a connection between the speech generation device and the internet, receiving an input identifying selected text from which to extract vocabulary from an internet-based vocabulary source, receiving an input identifying one or more pieces of the selected text to be analyzed, analyzing the one or more pieces of the selected text to determine words and phrases of interest, the speech generation device is configured to generate a text-to-speech output when at least one of the words and phrases of interest is selected from the scrolling view, adding the words and phrases of interest to one or more vocabulary lists stored on a computer-readable medium of the speech generation device, a display device for displaying images to a viewer, and a wireless network adaptor for providing access to a network

Group IV claims 65-77 - A method of implementing speech characterizations to the speech output of a speech generation device, the method comprising analyzing the selected text and the one or more associated speech characterizations to determine a text-to-speech engine for outputting the selected text and the one or more associated speech characterizations, examine the selected text and the one or more associated speech characterizations to determine an optimum text-to-speech engine for outputting the selected text and the one or more associated speech characterizations, a display device for displaying images to a viewer, one or more speakers for generating audio outputs,

Group V claims 78-82 - A speech generation device, comprising an outer housing, at least a portion of the outer housing being formed from magnesium or a magnesium alloy, configuring the speech generation device to generate text-to-speech output, wherein the battery is stored between the first and second bottom casing components such that the second bottom casing component forms the bottommost surface of the outer housing, the outer housing is formed from an injection molding process, and the processor is thermally coupled to the at least a portion of the outer housing

The inventions listed as Groups I to V do not relate to a single general inventive concept under PCT Rule 13 1 because, under PCT Rule 13 2, they lack the same or corresponding special technical features for the following reasons

The inventive concept of Group I is a speech generation device with an ergonomically designed casing for locating a user's fingers, a display for viewing images and a touch-screen for receiving inputs to the display device within a transparent panel, which is not present in Group II to V. The inventive concept of Group II is a wirelessly communicating integrated speech generation device that generates a menu enabling a user to view phone features and communicate with secondary devices, which is not present in Groups I or III to V. The inventive concept of Group III is a speech generation device for displaying images and providing wireless access to a network, the device selecting text from which to extract and incorporating Internet-based vocabulary into vocabulary list stored on the device for generating a text-to-speech output when one or more words and phrases of interest are determined from the selected text, which is not present in Groups I to II or IV to V. The inventive concept of Group IV is a speech generation device for displaying images and generating audio output, the device selecting text and the one or more associated speech characterizations to determine an optimum text-to-speech engine for outputting the selected text and the one or more associated speech characterizations, which is not present in Groups I to III or V. The inventive concept of Group V is a speech generation device for generating text-to-speech output with an outer housing being formed from magnesium or a magnesium alloy, injection molding, thermal couplings and a battery stored between bottom casing components forming the bottom surface of the housing, which is not present in Groups I to IV.

The common technical feature between all the Groups is a speech generation device. The common technical feature between Group I through IV is a speech generation device that displays images to a viewer. The common technical feature between Group I and IV is a speech generation device that displays images to a viewer and generates text-to-speech output. All of the common technical features mentioned above are known in the art and do not make a contribution over the prior art, thus the features are not special as evidenced by US 2008/0045199 A1 to Lee 21 February 2008, Fig 4A to 5C, para [0045], [0055]. Accordingly, unity of invention is lacking under PCT Rule 13 1.

Form PCT/ISA/210 (extra sheet) (July 2009)