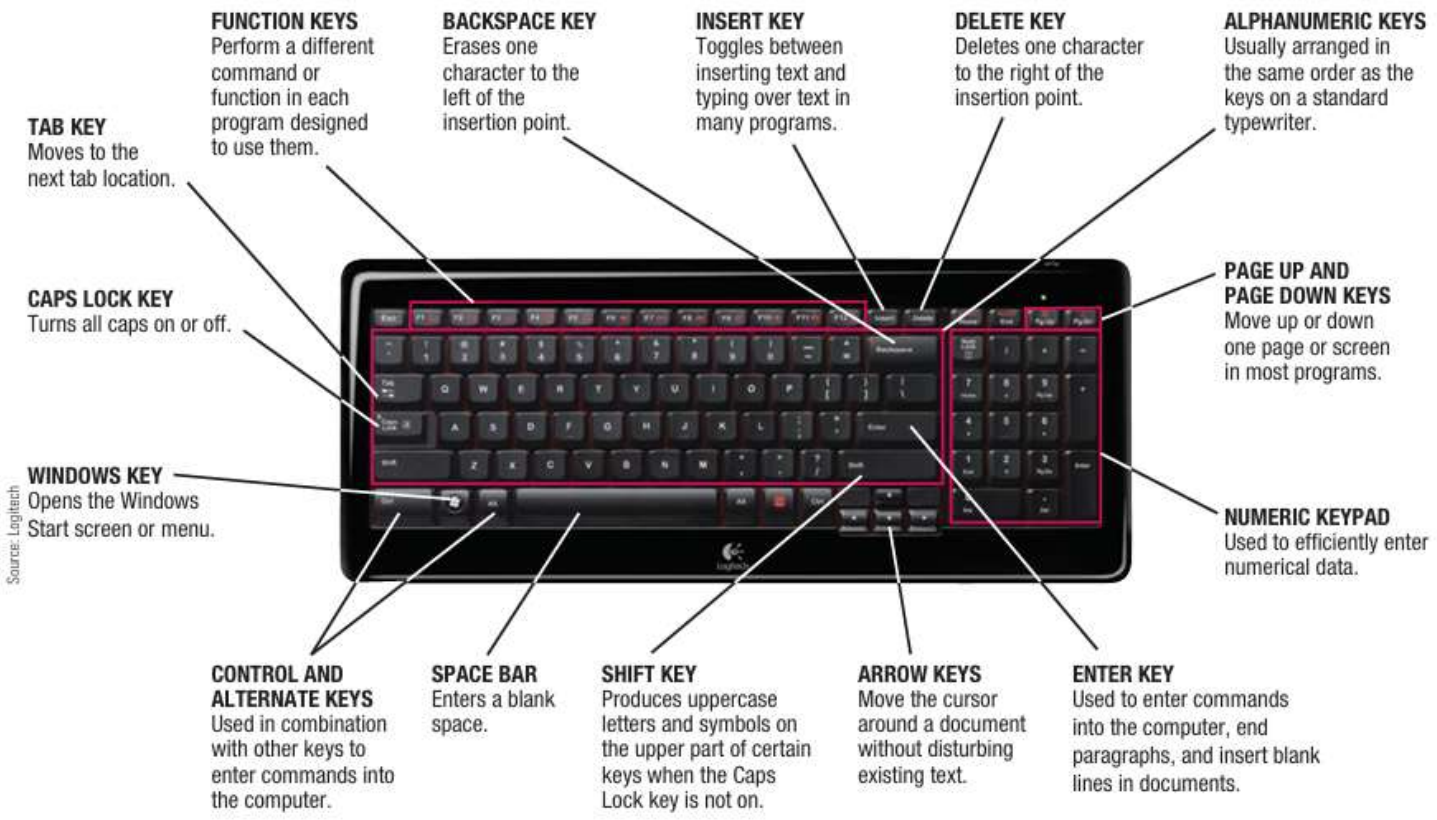
Keyboard

- Most computers today are designed to be used with a keyboard—a device used to enter characters at the location on the screen marked by the insertion point or cursor (typically a blinking vertical line).

- Many computer keyboards today include touch pads, scroll wheels, and other components for easier control over some functions, such as gesture input or scrolling through documents. Some keyboards also include a fingerprint reader or other biometric reader that can be used for identification purposes


FUNCTION KEYS
Perform a different command or function in each program designed to use them.
BACKSPACE KEY
Erases one character to the left of the insertion point.
INSERT KEY
Toggles between inserting text and typing over text in many programs.
DELETE KEY
Deletes one character to the right of the insertion point.
ALPHANUMERIC KEYS
Usually arranged in the same order as the keys on a standard typewriter.
TAB KEY
Moves to the next tab location.
CAPS LOCK KEY
Turns all caps on or off.
PAGE UP AND PAGE DOWN KEYS
Move up or down one page or screen in most programs.
WINDOWS KEY
Opens the Windows Start screen or menu.
NUMERIC KEYPAD
Used to efficiently enter numerical data.
CONTROL AND ALTERNATE KEYS
Used in combination with other keys to enter commands into the computer.
SPACE BAR
Enters a blank space.
SHIFT KEY
Produces uppercase letters and symbols on the upper part of certain keys when the Caps Lock key is not on.
ARROW KEYS
Move the cursor around a document without disturbing existing text.
ENTER KEY
Used to enter commands into the computer, end paragraphs, and insert blank lines in documents.
Source: Logitech

While some mobile devices have a built-in physical keyboard, many tablets, smart phones, and other mobile devices have only an on-screen keyboard that can be used with touch or pen input.

Source: Nuance

ON-SCREEN KEYBOARD
This keyboard is using the Swype app in which the user continuously drags through the letters in a word for faster input.

Source: Logitech

UNIVERSAL KEYBOARD
This keyboard can connect wirelessly to three devices at once and the user can switch between those devices.

Source: Whirlscape

ONE-ROW KEYBOARD
This on-screen keyboard uses software to try to determine and predict what the user is typing.

Pointing and Touch devices

- In addition to a keyboard, most computers today are used in conjunction with some type of pointing device. Pointing devices are used to select and manipulate objects, to input cer tain types of data (such as handwritten data), and to issue commands to the computer. The most common pointing devices are the mouse, the pen/stylus, and devices that use touch input.

Mice

The mouse is the most common pointing device for a desktop computer. It typically rests on the desk or other flat surface close to the user's computer, and it is moved across the surface with the user's hand in the appropriate direction to point to and select objects on the screen. As it moves, an on-screen mouse pointer—usually an arrow— moves accordingly. Once the mouse pointer is pointing to the desired object on the screen, the buttons on the mouse are used to perform actions on that object (such as to open a hyperlink, to select text, or to resize an image). Similar to keyboards, mice today typically connect via a USB port or via a wireless connection

- Older mechanical mice have a ball exposed on the bot tom surface of the mouse to control the pointer movement. Virtually all mice today are optical mice or laser mice that track movements with light (LED or laser light, respectively). There are also mice that support two-dimensional gestures, such as touch mice designed for Windows devices. Instead of buttons, these mice include a touch surface on top of the mouse in order to support finger swipes and other gestures for convenient.

TRADITIONAL MICE
Support pointing, clicking, and scrolling.

TOUCH MICE
Support swiping, tapping, and other navigational gestures.

Pens/Styluses

- Many devices today, including computers, tablets, and smartphones, can accept pen input; that is, input by writing, drawing, or tapping on the screen with a pen-like device called a stylus. Sometimes, the stylus (also called a digital pen, electronic pen, or pen) is simply a plastic device with no additional functionality; other times, it is a pressure-sensitive device that transmits the pressure applied by the user to the device that the stylus is being used with in order to allow more precise input. These more sophisticated styluses are typically powered by the device with which they are being used, have a smooth rounded tip so they don't scratch the screen, and contain buttons or switches to perform actions such as erasing content or right-clicking. The idea behind pen input and digital writing in general is to make using a computer or other device as convenient as writing with a pen, while adding the functionality that pen input can provide (such as converting handwritten pen input to editable typed text). Pen input is being used increasingly for photography, graphic design, animation, industrial design, document processing, and healthcare applications. In addition to supporting handwritten input (referred to as inking), digital pens can be used to navigate through a document and issue commands to the computer. Pens can also be used to provide easier touch input for mobile device users who have long fingernails, who wear gloves in the winter, or who have a device with a screen that is too small to have accurate touch input via a finger.

and mobile devices.

Source: Samsung Electronics Co., Ltd

SMARTPHONES

Source: Microsoft Corporation

TABLET COMPUTERS

Source: Wacom Company

DESKTOP COMPUTERS

Graphics Tablets

- A graphics tablet—also called a pen tablet or digitizing tablet—is a flat, touch-sensitive tablet used in conjunction with a digital pen. The graphics tab let is typically connected to a computer via a USB port or a wireless connection and any thing drawn or written on the graphics tablet is automatically transferred to the connected computer.

Signature capture devices

- Another type of pen-based input device is the signature capture device These devices are found most often at checkout counters to record signatures used to authorize credit card purchases electronically. Delivery companies, restaurants, retail stores, and other service businesses may also use a signature capture device—or a mobile device with a stylus and appropriate software—to record authorizing signatures.

Source: Livescribe, Inc.

DIGITAL WRITING SYSTEMS
Record all input written on the paper and transfer it to a device either in real time or when directed by the user.

Source: Wacom Company

GRAPHICS/PEN TABLETS
Transfer all input written or drawn on the tablet to the computer in real time and allow the use of pen navigation tools.

Courtesy Verifone

SIGNATURE CAPTURE DEVICES
Record signatures for purchases, deliveries, and other applications that require recorded authorization.

Touch screens

- Touch screens allow the user to touch the screen with his or her finger to select commands or otherwise provide input to the device associated with the touch screen. Touch screens are common on computers, as well as on smartphones and other mobile devices, in order to provide easy input. While desktop monitors, all-in one PCs, and conventional notebook computers can also use touch input, it is most practical (and comfortable) when the touch screen is not vertical; as a result, extensive touch input is most appropriate with hybrid notebook-tablet computers, mobile devices, and other devices that can be held in a more horizontal position.

Courtesy of Dell Inc.

PERSONAL COMPUTERS

Source: Amazon.com, Inc.

MOBILE DEVICES

Source: Microsoft Corporation

SURFACE HUBS

Source: Lenovo

TABLE PCS

Other pointing devices

A variety of gaming devices today can be used as controllers to supply input to a computer. For instance, the stick of a joystick can be moved with the hand to move an on-screen object (such as a player or vehicle in a game)

These include game pads and steering wheels; guitars, drums, and other musical instruments; dance pads, balance boards, and other motion sensitive controllers; and proprietary controllers such as the Wii Remote, Xbox Kinect, and PlayStation Move.

GAMING DEVICES
Most often used for gaming applications.

Trackballs

- Similar to an upside-down mechanical mouse, a trackball has the ball mechanism on top, instead of on the bottom. The ball is rotated with the thumb, hand, or finger to move the on-screen pointer. Because the device itself does not need to be moved, track balls take up less space on the desktop than mice and they can be used on a variety of surfaces.

control buttons and wheels

- Many consumer devices today, such as smart watches, GPS devices, and handheld gaming devices, use special control buttons and wheels to select items and issue commands to the device. For instance, the Apple Watch has a Digital Crown button that is used as a pointing device to zoom and scroll; pressing the button returns to the Watch Home screen.

Touch pads

- A touch pad is a touch-sensitive pad across which a fingertip or thumb slides to move the on-screen pointer; tapping the touch pad (or one of its associated buttons) typically per forms clicks and other mouse actions. Touch pads are the most common pointing device for notebook and netbook computers. They are used to point to and select objects, to scroll through documents or other content, and to perform gestures such as swiping and pinching. Because touch is so integrated into the newest operating systems (such as the most recent versions of Windows and OS X), there are also stand-alone touch pads available that can be used with computers that don't have a touch screen. Touch pads are also built into some keyboards.

Source: Logitech

TRACKBALLS
An alternative to a mouse that has all tracking mechanisms on the top surface.

byggarn.se/Shutterstock.com; Logitech

TOUCH PADS
Commonly found on notebook and netbook computers (left); also available as stand-alone devices (right).

- There are a variety of input devices designed to capture data in digital form so a computer can manipulate it. Some devices (such as scanners and readers) convert data that already exists in physical form (such as on source documents like photographs, checks, or prod uct labels); other devices (such as digital cameras) capture data initially in digital form. Automating the data entry process is referred to as source data automation and can refer to capturing data electronically from a source document or entering data directly into a computer at the time and place the data is generated

Scanners

A scanner, more officially called an optical scanner, captures an image of an object (usually a flat object, such as a printed document or photograph) in digital form, and then transfers that data to a computer. Typically, the entire document (including both text and images) is input as a single image that can be resized, inserted into other documents, posted on a Web page, e-mailed to someone, printed, or otherwise treated like any other graphical image. The text in the scanned image, however, cannot be edited unless optical character recognition (OCR) software is used in conjunction with the scanner to input the scanned text as individual text characters.

Types of scanners

- **Flatbed scanners** are designed to scan flat objects one page at a time, and they are the most common type of scanner. Flatbed scanners work in much the same way that photocopiers do—whatever is being scanned remains stationary while the scanning mechanism moves underneath it to capture the image.

- **Portable scanners** are designed to capture text and other data while on the go. Some are full-page portable scanners that can capture images of an entire document (such as a printed document or receipt); others are handheld scanners designed to capture text one line at a time. In either case, the scanner is typically powered by batteries, the scanned content is stored in the scanner, and the content is trans ferred to a computer (via a cable or a wireless connection) when needed. Some handheld scanners have OCR capabilities and some of these can also be used to translate scanned text from one language to another. One recent option is a scanner built into a mouse to enable users to switch between mouse actions and scanning as needed.

FLATBED SCANNERS
Used to input digital copies of photos, sketches, slides, book pages, and other relatively flat documents into the computer.

Source: Wizcomtech LTD

PORTABLE SCANNERS
Used to capture digital copies of documents while on the go; the data is typically transferred to a computer at a later time.

Courtesy Creaform

PORTABLE 3D SCANNERS
Used to capture 3D digital images of a person or an object.

Scanning quality and resolution

- The quality of scanned images is indicated by optical resolution, usually measured in the number of dots per inch (dpi). When a document is scanned (typically using scanning software, though some application programs allow you to scan images directly into that program), the resolution of the scanned image can often be specified. The resolution can also be reduced if needed (such as to compress an image to reduce its file size before posting it on a Web page) using an image editing program. Scanners today usually scan at between 75 dpi and 6,400 dpi. A higher resolution results in a better image but also results in a larger file size. Images need to be scanned at a higher resolution, however, if the image (or a part of it) will be enlarged significantly. The file size of a scanned image is also determined in part by the physical size of the image. Once an image has been scanned, it can usually be resized and then saved in the appropriate file format and resolution for the application with which the image is to be used.

96 dpi
(833 KB)

300 dpi
(1,818 KB)

600 dpi
(5,374 KB)

RESOLUTION

Most scanners let you specify the resolution (in dpi) to use for the scan. High-resolution images look sharper but result in larger file sizes.

Readers

- A variety of readers are available to read the different types of codes and marks used today, as well as to read an individual's biometric characteristics.
- **Barcode readers** A barcode is an optical code that represents data with bars of varying widths or heights. Two of the most familiar barcodes are UPC (Universal Product Code), which is the type of barcode found on packaged goods in supermarkets and other retail stores, and ISBN (International Standard Book Number), which is the type of barcode used with printed books A newer barcode designed for small consumer goods like fresh food is DataBar. Businesses and organizations can also create and use custom barcodes to fulfill their unique needs.

- Barcodes are read with barcode readers. Barcode readers use either light reflected from the barcode or imaging technology to interpret the bars contained in the barcode as the numbers or letters they represent. Then, data associated with that barcode— typically identifying data, such as to uniquely identify a product, shipped package, or other item—can be retrieved. Fixed barcode readers are frequently used in point-of-sale (POS) systems; portable barcode readers are also available for individuals who need to scan barcodes while on the go, such as while walking through a warehouse, retail store, hospital, or other facility. In addition, with the appropriate mobile app, smartphones and tablets can read barcodes and digital watermarks, such as to access information and features offered by a QR code or digital watermark, or to comparison shop for products by capturing UPC codes

FIXED BARCODE READERS
Used most often in retail point-of-sale applications.

Courtesy Honeywell International Inc.

PORTABLE BARCODE READERS
Used when portability is needed.

Bloomua/Shutterstock.com

INTEGRATED BARCODE READERS
Used most often for consumer applications.

RADIO FREQUENCY IDENTIFICATION (RFID) AND NEAR FREQUENCY IDENTIFICATION (NFC) READERS

- Radio frequency identification (RFID) is a technology that can store, read, and transmit data located in RFID tags. RFID tags contain tiny chips and radio antennas; they can be attached to objects, such as products, price tags, shipping labels, ID cards, assets (such as livestock, vehicles, computers, and other expensive items), and more. The data in RFID tags is read by RFID readers. Whenever an RFID-tagged item is within range of an RFID reader (up to 300 feet or more, depending on the type of tag and the radio frequency being used), the tag's built-in antenna allows the information located within the RFID tag to be sent to the reader. Unlike barcodes, RFID tags only need to be within range (not within line of sight) of a reader. This enables RFID readers to read the data stored in many RFID tags at the same time and read them through cardboard and other materials—a definite advantage for shipping and inventory applications.

- Another advantage over barcodes is that the RFID tag attached to each item is unique (unlike UPC codes, for instance, that have the same code on all instances of a single product), so each tag can be identified individually and the data can be updated as needed. In addition, the data stored in RFID chips can be updated during the life of a product (such as to record information about a product's origin, shipping history, and the temperature range the item has been exposed to) and that information can be read when needed (such as at a product's final destination). One disadvantage of RFID technology is cost, though the chipless, printable RFID tags in development are expected to eventually drop the cost to less than a tenth of a cent per tag.
- This reduced cost plus the many advantages of RFID over barcodes make it possible that RFID may eventu ally replace barcodes on product labels and price tags. Because RFID technology can read numerous items at one time, it is also possible that, someday, RFID will allow a consumer to perform self-checkout at a retail store by just pushing a shopping cart past an RFID reader, which will ring up all items in the cart at one time.

- RFID is used today for many different applications . Some of the initial RFID applications were tracking the movement of products and shipping containers during transit, tagging pets and livestock, and tracking tractors and other large assets. Many of these applications use GPS technology in conjunction with RFID to provide location information for the objects to which the RFID tags are attached. RFID is also used by prescription drug manufacturers to comply with government requirements that drugs be tracked throughout their life cycles and to track food products and sources. For example, all cows, sheep, and goats in Australia are required to have RFID ear tags so that animals can be traced from birth to slaughter and diseased animals can be tracked back to their ranches.

Courtesy Honeywell International Inc.

SHIPPING
This portal RFID reader reads RFID tags attached to the shipping container or to items inside the container as it passes through the portal.

Courtesy Honeywell International Inc.

WAREHOUSING
This handheld RFID reader is used to read the RFID tags located on the warehouse shelves, as well as on the pallets currently stored there.

Source: MasterCard Worldwide

MOBILE PAYMENTS
This stationary NFC reader is used at checkout

Source: teamaxess.com

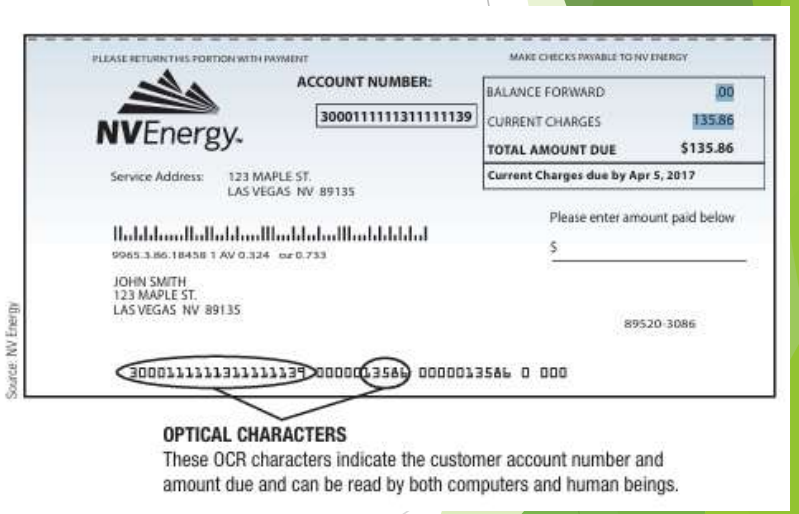
TICKETING
This stationary RFID reader is used to automatically open ski lift

Optical Mark readers (OMrs)

- Optical mark readers (OMRs) input data from optical mark forms to score or tally exams, questionnaires, ballots, and so forth. Typically, you use a pencil to fill in small circles or other shapes on the form to indicate your selections, and then the form is inserted into an optical mark reader to be scored or tallied. The results can be input into a computer system if the optical mark reader is connected to a computer.

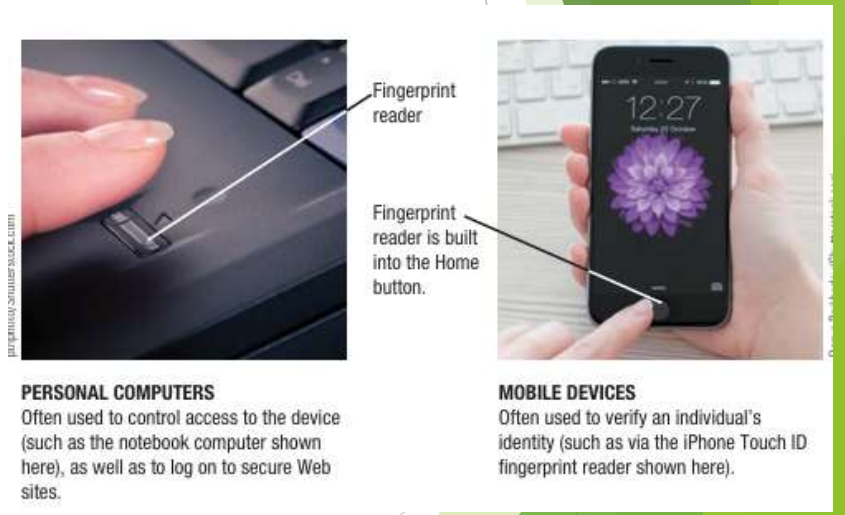
Optical character recognition (Ocr) devices

- Optical character recognition (OCR) refers to the ability of a computer to recognize text characters printed on a document. The characters are read by a compatible scanning device, such as a flatbed scanner or dedicated OCR reader, and then OCR software is used to identify each character and convert it to edit able text. While OCR systems can recogniz many different types of printed characters, optical characters—which are characters specifically designed to be identifiable by humans as well as by an OCR device—are ofte used on documents intended to be processed by an OCR system. For example, optical characters are widely used in processing turnaround documents, such as the monthly bills for credit card and utility companies These documents contain optical characters in certain places on the bill to aid processing when consumers send it back with payment—or "turn it around.



Biometric Readers

- Biometrics is the science of identifying individuals based on measurable biological characteristics. Biometric readers are used to read biometric data about a person so that the individual's identity can be verified based on a particular unique physiological characteristic (such as a fingerprint or a face) or personal trait (such as a voice or a signature). Biometric readers can be stand-alone or built into a computer or mobile device they can also be built into another piece of hardware, such as a keyboard, an external hard drive, or a USB flash drive. Biometric readers can be used to allow only authorized users access to a computer or facility or to the data stored on a storage device, as well as to authorize electronic payments, log on to secure Web sites, or punch in and out of work.



PERSONAL COMPUTERS
Often used to control access to the device (such as the notebook computer shown here), as well as to log on to secure Web sites.

MOBILE DEVICES
Often used to verify an individual's identity (such as via the iPhone Touch ID fingerprint reader shown here).

Digital cameras

- Digital cameras work much like conventional film cameras, but instead of recording images on film, they record them on a digital storage medium, such as a flash memory card, embedded flash memory, or a built-in hard drive. Digital cameras are usually designated either as still cameras (which take individual still photos) or video cameras (which capture moving video images), although many cameras today take both still images and video.

Source: Sony Electronics Inc.; MaszaS/Shutterstock.com

PREVIEWS
Virtually all digital cameras let you display and erase images.

STORAGE MEDIA
Most cameras use removable storage media in addition to, or instead of, built-in storage.

Source: Kingston Technology Corporation

Source: Kingston Technology Corporation

PROFESSIONAL DIGITAL CAMERAS

Source: Motorola Mobility LLC

Audio Input

- Audio input is the process of entering audio data into the computer. The most common types of audio input are voice and music. voice input and speech recognition systems Voice input—inputting spoken words and converting them to digital form—is typically performed via a microphone, which is often built into the computer or mobile device being used. It can be used in conjunction with sound recorder software to store the voice in an audio file, such as to create a podcast or perform legal or medical dictation. It can also be used to place voice phone calls, as well as in conjunction with speech recognition software to provide spoken instructions to a computer.

Speech recognition systems

- Speech recognition systems enable the device being used to recognize voice input as spoken words. It requires appropriate software, such as Dragon NaturallySpeaking or Windows Speech Recognition, in addition to a microphone. With speech recognition, voice input can be used to control the computer, such as opening and closing programs, selecting options from a menu or list, and moving the insertion point. It can also be used to input and edit text, including dictating text to be typed, selecting text to be formatted or edited, deleting text, correcting errors, and so forth. Speech recognition systems are used by individuals who cannot use a keyboard, as well as by individuals who prefer not to use a keyboard or who can generate input faster via a voice input system. For instance, medical and legal transcription is one of the most frequently used speech recognition applications at the present time.

1. The user speaks into a microphone that cancels out background noise and inputs the speech into the computer.

Sebastian Gauert/Shutterstock.com

2. An analog-to-digital converter on the sound card or integrated sound component located inside the system unit converts the spoken words to digital form.

OmniArt/Shutterstock.com

3. Voice recognition software converts the words to phonemes and then determines the words that were spoken.

4. The spoken words appear on the screen in the application program (such as a word processor or an e-mail program) being used.