**COMPUTER INPUT DEVICES**

 Engineers have been especially creative in designing new ways to get information into computers. Some input methods are highly specialized and unusual, while common devices often undergo redesign to improve their capabilities or their ergonomics, the ways in which they affect people physically. Some common input devices include keyboards, mice, trackballs, and touch pads.

**Keyboard**

 A keyboard can be an external device that is attached by means of a cable, or it can be attached to the CPU case itself as it is for laptop computers. Most keyboards today are QWERTY keyboards, which take their name from the first six keys at the left of the first row of letters. An alternative, the DVORAK keyboard, places the most commonly used keys close to the user’s fingertips and speeds typing.

 Many keyboards have a separate numeric keypad, like that of a calculator, containing numbers and mathematical operators. All keyboards have modifier keys that enable the user to change the symbol or character that is entered when a given key is pressed. The Shift key, for example, makes a letter uppercase. Keyboards also have special cursor keys that enable the user to change the position on the screen of the cursor, a symbol that appears on the monitor to show where in a document the next change will appear. Most keyboards also have function keys, labeled F1, F2, F3, and so on. These keys allow the user to issue commands by pressing a single key.

**Mouse**

 Graphical operating systems contain many elements that a user can choose by pointing at them. Such elements include buttons, tools, pull-down menus, and icons for file folders, programs, and document files. Often pointing to and clicking on one of these elements is more convenient than using the cursor or arrow keys on the keyboard. This pointing and clicking can be done by using a mouse. The mouse is the second most common input device, after the keyboard. A mouse operates by moving the cursor on the computer screen to correspond to movements made with the mouse.

**Trackball**

 A trackball is like an upside-down mouse. A mouse is moved over a pad. A trackball remains stationary, and the user moves the ball with his or her fingers or palm. One or more buttons for choosing options are incorporated into the design of the trackball.

**Touch Pad and Touch Screen**

 A touch pad feels less mechanical than a mouse or trackball because the user simply moves a finger on the pad. A touch pad has two parts. One part acts as a button, while the other emulates a mouse pad on which the user traces the location of the cursor with a finger. People with carpal tunnel syndrome find touch pads and trackballs easier to use than mice. Many portable computers have built-in trackballs or touch pads as input devices.

 A touch screen allows the user to choose options by pressing the appropriate part of the screen. Touch screens are widely used in bank ATMs and in kiosks at retail outlets and in tourist areas.

**COMPUTER OUTPUT DEVICES**

 To get information into a computer, a person uses an input device. To get information out, a person uses an output device. Some common output devices include monitors, printers, and speakers.

**Monitor**

 A monitor, or screen, is the most common output device used with a personal computer. A monitor creates a visual display and is either built into the CPU case or attached as an external device by means of a cable. Sometimes the cable is connected to a circuit board called a video card placed into an expansion slot in the CPU.

 Most monitors make use of a cathode-ray tube, or CRT, much like the tube found in a conventional television. The CRT takes up a lot of room and extends rearward. Most portable computers, in contrast, use liquid crystal displays, or LCDs, which are convenient for portables because they are thin, lightweight, and consume very little power.

**Printer**

 After monitors, printers are the most important output devices. The print quality produced by these devices is measured in dpi, or dots per inch. As with screen resolution, the greater the number of dots per inch, the better the quality. The earliest printers for personal computers were dot matrix printers that used perforated computer paper. These impact printers worked something like typewriters, transferring the image of a character by using pins to strike a ribbon.

 A laser printer uses a laser beam to create points of electrical charge on a cylindrical drum. Toner, composed of particles of ink with a negative electrical charge, sticks to the charged points on the positively-charged drum. As the page moves past the drum, heat and pressure fuse the toner to the page.

 Inkjet printers generally provide at least 300 dpi resolution, although high-resolution inkjets are available. Quieter than dot matrix printers, these also use a print head that moves across the page. Instead of striking the page, the small cartridge sprays a fine mist of ink when an electrical charges moves through the print cartridge. An inkjet printer can use color cartridges and so provides affordable color printing suitable for home and small office use.