

# 1 Basic Computing Concepts (2) Input Devices

## 1.10 Keyboard

On most computers, a keyboard is the primary text input device (the mouse is also a primary input device but lacks the ability to easily transmit textual information). The keyboard also contains certain standard function keys, such as the Escape key, Tab and Cursor movement keys, Shift and Control keys.

The computer keyboard uses the same key arrangement as the mechanical and electronic typewriter keyboards that preceded the computer. The standard arrangement of alphabetic keys is known as the QWERTY keyboard, its name deriving from the arrangement of the five keys at the upper left of the three rows of alphabetic keys. This arrangement, invented for one of the earliest mechanical typewriters, dates back to the 1870s.

Another well-known key arrangement is the Dvorak system, which was designed to be easier to learn and use. The Dvorak keyboard was designed with the most common consonants on one side of the middle or home row and the vowels on the other side so that typing tends to alternate key strokes back and forth between hands. Although the Dvorak keyboard has never been widely used, it has adherents.

Because many keyboard users develop a cumulative trauma disorder, such as carpal tunnel syndrome, a number of ergonomic keyboards have been developed. Approaches include keyboards contoured to alleviate stress and foot-driven pedals for certain keys or keyboard functions.



**Diagram 1. A normal QWERTY keyboard**

The keys on computer keyboards are often classified as follows:

- alphanumeric keys -- letters and numbers
- punctuation keys -- comma, period, semicolon, and so on
- special keys -- function keys, control key, arrow keys, Caps Lock key, and so on

The QWERTY keyboard was designed in the 1800s for mechanical typewriters and was actually designed to slow typists down to avoid jamming the keys.



**Diagram 2. An ergonomic keyboard**

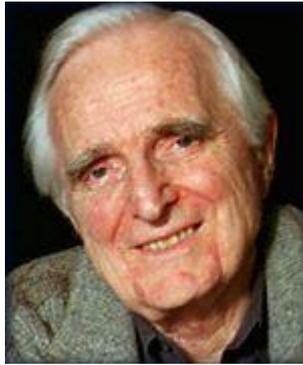
There is no standard computer keyboard, although many manufacturers imitate the keyboards of PCs. There are actually three different PC keyboards: the original PC keyboard, with 84 keys; the AT keyboard, also with 84 keys; and the enhanced keyboard, with 101 keys. The three differ somewhat in the placement of function keys, the Control key, the Return key, and the Shift keys.

In addition to these keys, IBM keyboards contain the following keys: Page Up, Page Down, Home, End, Insert, Pause, Num Lock, Scroll Lock, Break, Caps Lock, and Print Screen.

There are several different types of keyboards for the Apple Macintosh. All of them are called ADB keyboards because they connect to the Apple Desktop bus (ADB). The two main varieties of Macintosh keyboards are the standard keyboard and the extended keyboard, which has 15 additional special-function keys.

## 1.11 Mouse

The mouse first became a widely-used computer tool when Apple Computer made it a standard part of the Apple Macintosh. Today, the mouse is an integral part of the graphical user interface (GUI) of any personal computer. As the mouse is moved over the surface in any direction, a sensor sends impulses to the computer that causes a mouse-responsive program to reposition a visible indicator (called a cursor) on the display screen.



**Diagram 3. Douglas Engelbart is the inventor of the mouse.**

The most conventional kind of mouse has two buttons on top: the left one is used most frequently. In the Windows operating systems, it lets the user click once to send a "Select" indication. In the Windows operating systems, double-click on the left button causes a program to be started. The second button, on the right, usually provides some less-frequently needed capability say to view a drop-down menu. Some mouse manufacturers also provide a version for left-handed people.

Windows 95 and other operating systems let the user adjust the sensitivity of the mouse, including how fast it moves across the screen, and the amount of time that must elapse within a "double click". In some systems, the user can also choose among several different cursor appearances. Some people use a mouse-pad to improve traction for the mouse ball.

The mouse's design continues to evolve. Some mice have a 'stick' or 'scroll wheel' that lets you scroll a Web page or other content up or down and right or left.

Invented by Douglas Engelbart of Stanford Research Center in 1963 and pioneered by Xerox in the 1970s, some consider the mouse as one of the great breakthroughs in computer ergonomics.

There are three basic types of mice:

- Mechanical: Has a rubber or metal ball on its underside.
- Optomechanical: Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.
- Optical: Uses a laser to detect the mouse's movement. Optical mice have no mechanical moving parts.

Cordless mice aren't physically connected at all. Instead they rely on infrared or radio waves to communicate with the computer.

## 1.12 Trackball

This is another pointing device. Essentially, a trackball is a mouse lying on its back. To move the pointer, you rotate the ball with your thumb, your fingers, or the palm of your hand. There are usually one to three buttons next to the ball, which you use just like mouse buttons.

The advantage of trackballs over mice is that the trackball is stationary so it does not require much space to use it. In addition, you can place a trackball on any type of surface, including your lap. For both these reasons, trackballs are popular pointing devices for portable computers.



**Diagram 4. Trackballs**

The trackball is usually located in front of the keyboard toward the user or is integrated into the middle of the keyboard keys.

### 1.13 Trackpoint

A TrackPoint, also called a pointing stick, is a cursor control device found in some notebook computers. The device is sometimes called an eraser pointer because it is roughly the size and shape of a pencil eraser. It is located in the middle of the keyboard between the G, H, and B keys.

The TrackPoint is operated by pushing in the general direction the user wants the cursor to move. Increasing pressure causes faster movement. The relation between pressure and cursor or pointer speed can be adjusted, in a manner similar to the way the mouse speed is adjusted in a traditional desktop computer. The TrackPoint system, originally introduced by IBM in 1992, has acquired a devoted following of people who prefer it to the older trackball and the more recent touch pad methods of cursor or pointer control in notebook computers.



**Diagram 5. A trackpoint**

### 1.14 Touchpad

A touchpad is a small, touch-sensitive pad used as a pointing device on some portable computers. By moving a finger or other object along the pad, you can move the pointer on the display screen. Tapping the pad is equivalent to clicking by means of a mouse.



**Diagram 6. A touchpad**

A touch pad works by sensing the user's finger movement and downward pressure. The first touch pad was invented by George E. Gropheide in 1988. Apple Computer was the first to license and use the touch pad.

### 1.15 Joystick

A joystick is a lever that moves in all directions and controls the movement of a pointer or some other display symbol. A joystick is similar to a mouse, except that with a mouse the cursor stops moving as soon as you stop moving the mouse. With a joystick, the pointer continues moving in the direction the joystick is pointing. To stop the pointer, you must return the joystick to its upright position. Joysticks are used mostly for computer games, but they are also used occasionally for CAD/CAM systems and other applications. It often has one or more push-buttons, called switches, whose position can also be read by the computer.

The joystick got its name from the control stick used by a pilot to control the ailerons and elevators of an airplane.



**Diagram 7. Joysticks**

### 1.16 Scanner



**Diagram 8. A hand-held and a flatbed scanner**

A scanner is a device that can read text or illustrations printed on paper and translate the information into a form the computer can use. A scanner works by digitizing an image i.e. by dividing it into a grid of boxes and representing each box with either a zero or a one, depending on whether the box is filled in (for colour and gray scaling, the same principle applies, but each box is then represented by up to 24 bits). The resulting matrix of bits, called a bit map, can then be stored in a file, displayed on a screen, and manipulated by programs.

Most optical scanners sold today come with OCR (optical character recognition) packages. This system translates the image into ASCII characters.

Scanners differ from one another in the following respects:

- Scanning technology: Most scanners use charge-coupled device (CCD) arrays, which consist of tightly packed rows of light receptors that can detect variations in light intensity and frequency. Industry-strength drum scanners use a different technology that relies on a photomultiplier tube (PMT), but this type of scanner is much more expensive than the more common CCD -based scanners.
- Resolution: The denser the bit map, the higher the resolution. Typically, scanners support resolutions of from 72 to 600 dpi.
- Bit depth: The number of bits used to represent each pixel. The greater the bit depth, the more colours or grayscales can be represented. For example, a 24-bit colour scanner can represent 2 to the 24th power (16.7 million) colours. Note, however, that a large colour range is useless if the CCD arrays are capable of detecting only a small number of distinct colors.
- Size and shape: Some scanners are small hand-held devices that you move across the paper. These hand-held scanners are often called half-page scanners because they can only scan 2 to 5 inches at a time.

Hand-held scanners are adequate for small pictures and photos, but they are difficult to use if you need to scan an entire page of text or graphics. Larger scanners include machines into which you can feed sheets of paper. These are called sheet-fed scanners. Sheet-fed scanners are excellent for loose sheets of paper, but they are unable to handle bound documents.

A second type of large scanner, called a flatbed scanner, is like a photocopier machine. It consists of a board on which you lay books, magazines, and other documents that you want to scan.

### 1.17 Touch Screen

A touch screen is a computer display screen that is also an input device. The user can interact with the computer by touching pictures or words on the screen. There are

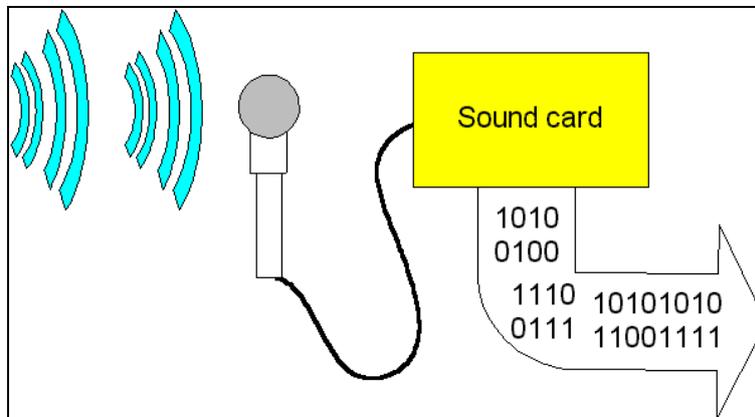


**Diagram 9. A touch screen**

various technologies that implement touch screens.

### 1.18 Microphone

The microphone converts audio signals to electrical waves and these are then converted by electronic circuitry in the computer to digital form.



**Diagram 10. A touch screen**

Highly sophisticated speech-recognition software can also recognize the spoken word and convert it to text.

### 1.19 Light Pen

A light pen is a light-sensitive stylus wired to a video terminal used to draw pictures or select menu options. The user brings the pen to the desired point on screen and presses the pen button to make contact. Contrary to what it looks like, the pen does not shine light onto the screen; rather, the screen beams into the pen. Screen pixels are constantly being refreshed. When the user presses the button, the pen senses light, and the pixel being illuminated at that instant identifies the screen location.



**Diagram 11. A touch screen**

## 1.20 Digitizing Tablet

A digitizing tablet is an input device that enables you to enter drawings and sketches into a computer. A digitizing tablet consists of an electronic tablet and a cursor or pen. A cursor (also called a puck) is similar to a mouse, except that it has a window with cross hairs for pinpoint placement, and it can have as many as 16 buttons. A pen (also called a stylus) looks like a simple ballpoint pen but uses an electronic head instead of ink. The tablet contains electronics that enable it to detect movement of the cursor or pen and translate the movements into digital signals that it sends to the computer.



**Diagram 12. Digitising tablets**

For digitizing tablets, each point on the tablet represents a point on the display screen in a fixed manner. This differs from mice, in which all movement is relative to the current cursor position. The static nature of digitizing tablets makes them particularly effective for tracing drawings. Most modern digitizing tablets also support a mouse emulation mode, in which the pen or cursor acts like a mouse.

Digitizing tablets are also called digitizers, graphics tablets, touch tablets, or simply tablets.

### 1.21 Digital Camera

A digital camera (or digicam for short) is a camera that takes video or still photographs, or both, digitally by recording images via an electronic image sensor. Many compact digital still cameras can record sound and moving video as well as still photographs.



**Diagram 13. Digital cameras**

Many devices include digital cameras built into or integrated into them. For example, mobile phones often include digital cameras; those that do are sometimes known as camera phones. Other small electronic devices (especially those used for communication) such as PDAs, laptops and BlackBerry/iPhone devices often contain an integral digital camera, as do some digital camcorders.

The resolution of a digital camera is often limited by the camera sensor.

Digital cameras can do things film cameras cannot:

- displaying images on a screen immediately after they are recorded,
- storing thousands of images on a single small memory device,
- recording video with sound,
- deleting images to free storage space

### 1.22 Webcam

A webcam is a video camera which feeds its images in real time to a computer or computer network, often via USB, Ethernet or Wi-Fi.

Their most popular use is the establishment of video links, permitting computers to act as videophones or videoconference stations. Other popular uses include security surveillance and computer vision. The webcam was first developed in 1991. Improved video quality has helped webcams encroach on traditional video conferencing systems.



**Diagram 14. A web-cam with its corresponding program**

Webcam features and performance can vary by program, computer operating system, and also by the computer's processor capabilities. For example, 'high-quality video' is principally available to users of certain Logitech webcams if their computers have dual-core processors meeting certain specifications.

Webcams are also used as security cameras. Software is available to allow PC-connected cameras to watch for movement and sound, recording both when they are detected; these recordings can then be saved to the computer, e-mailed or uploaded to the Internet.

Webcams can be used to take Video clips and still pictures.

### 1.23 MICR

Magnetic Ink Character Recognition, or MICR, is a character recognition technology adopted mainly by the banking industry to facilitate the processing of cheques. In addition to their unique fonts, MICR characters are printed with a magnetic ink or toner, usually containing iron oxide.

Magnetic printing is used so that the characters can be reliably read into a system, even when they have been overprinted with other marks such as cancellation stamps.



**Diagram 15. A cheque with MICR characters**

## 1.24 OMR

Optical Mark Recognition (also called Optical Mark Reading) is the process of capturing human-marked data from document forms such as surveys and tests. Many traditional OMR devices work with a dedicated scanner device that shines a beam of light onto the form paper. The contrasting reflectivity at predetermined positions on a page is then utilized to detect the marked areas because they reflect less light than the blank areas of the paper.



**Diagram 16. An OMR document**

Some OMR devices use forms which are preprinted onto 'transoptic' paper and measure the amount of light which passes through the paper, thus a mark on either side of the paper will reduce the amount of light passing through the paper.

a common desktop image scanner with a document feeder to process the forms once filled out.

In contrast to the dedicated OMR device, desktop OMR software allows a user to create their own forms in a word processor and print them on a laser printer. The OMR software then works with

OMR is generally distinguished from optical character recognition by the fact that a complicated pattern recognition engine is not required. That is, the marks are constructed in such a way that there is little chance of not reading the marks correctly.

## 1.25 OCR

Optical character recognition is the translation of images of handwritten, typewritten or printed text (usually captured by a scanner) into machine-editable text.

Early systems required training (the provision of known samples of each character) to read a specific font. "Intelligent" systems with a high degree of recognition accuracy for most fonts are now common. Some systems are even capable of reproducing formatted output that closely approximates the original scanned page including images, columns and other non-textual components.



**Diagram 17. A hand-held OCR**

## 1.26 Barcode

A barcode reader (or barcode scanner) is an electronic device for reading printed barcodes. Like a flatbed scanner, it consists of a light source, a lens and a light

sensor to translate optical impulses into electrical ones. Additionally, nearly all barcode readers analyse the barcode's image data provided by the sensor and send the barcode's content to the scanner's output port.

The main advantage of using a barcode system is that any price change only needs to be made to the database and not every single product package. Barcodes are also used on books to show the book's ISBN number. They are also used on library tickets so that when your ticket is scanned, the database brings up your account and any books which you still have out on loan are displayed.



**Diagram 18. Barcode**

### 1.27 Magnetic Stripe Card

A magnetic stripe card is a type of card capable of storing data by modifying the magnetism of tiny iron-based magnetic particles on a band of magnetic material on the card.

The magnetic stripe, sometimes called a magstripe, is read by physical contact and swiping past a reading head. Magnetic stripe cards are commonly used in credit cards, identity cards, and transportation tickets.



**Diagram 19. A card with a magnetic stripe**

## Exercise

1. What is the difference between a QWERTY keyboard and a Dvorak keyboard?
2. What do we mean by the following terms?
  - a. Repetitive strain injury
  - b. Cumulative trauma disorder
  - c. Carpal tunnel syndrome
3. What is ergonomics about?
4. What is different in an ergonomic keyboard?
5. What are alphanumeric keys?
6. Name one advantage and one disadvantage of keyboards.
7. What is a GUI?
8. Today almost all mice are optical. True?
9. Cordless mice rely on infrared or radio waves. What is the difference between these two technologies?
10. Give one advantage and one disadvantage of mice.
11. Give one advantage and one disadvantage of trackballs.
12. Give one advantage and one disadvantage of trackpoints.
13. Give one advantage and one disadvantage of touchpads.
14. Give one advantage and one disadvantage of joysticks.
15. What is CAD/CAM system?
16. Give one advantage and one disadvantage of scanners.
17. Explain the following terms:
  - a. Bit map
  - b. OCR
  - c. ASCII
  - d. Resolution
  - e. dpi
  - f. Bit depth
18. Give one advantage and one disadvantage of touch screens.
19. Give one advantage and one disadvantage of microphones.
20. Explain the following terms:
  - a. sound card
  - b. speech-recognition software
21. Name one application of a digitizing tablet.

22. Explain the following terms. They are related to digital cameras.
- a. 10 megapixel
  - b. cropping
  - c. 10X optical zoom
  - d. digital zoom
  - e. JPEG
  - f. RAW
  - g. LCD
  - h. ISO
  - i. shutter speed
  - j. aperture
  - k. depth of field
23. A webcam is a video camera which feeds its images in real time to a computer or computer network, often via USB, Ethernet or Wi-Fi. Explain.
24. Give one advantage of MICR.
25. Mention one application where the following input techniques can be used (one application for each):
- a. OMR
  - b. OCR
  - c. Barcode
  - d. Magnetic stripe card