Chapter 5

Input Devices

These are the devices with the help of which we provide input to the computer. The input can be in the form of numbers, alphabets, images, audio or video. There are various input devices available.

Keyboard

One of the most important devices to the computer is the keyboard. Without the keyboard there's not much one could do. During the booting process the computer always checks to see whether or not a keyboard is attached to the system. If the keyboard is not present an error message will be displayed on the screen.

A keyboard has a set of keys with symbols that are understood by humans. When somebody presses a key, a microprocessor in the keyboard interprets the signal generated as a digital code and this is sent to the computer. There are two types of keyboards:

Fig 5.1 Keyboard

1. Switches
2. Capacitive

Inner working of a keyboard that uses switch technology.

The keyboards based upon switch technology use a mechanical switch for every key on the keyboard. The switch makes a mechanical connection for an instance and sends a signal to the keyboards microprocessor. The keys are located in a grid called keyboard matrix. The processor can identify when a key is pressed where the switch lies in the matrix and also it could detect for how long the key has been pressed as well if there was a combination of keystrokes been hit.

Once the key and the press have been identified, the processor converts this information into a scan code. Each key has its own code for depression and key combinations. There are a variety of keyboards that are based upon switch technology some of them are:

1. Pure mechanical
2. Foam element
3. Rubber dome
4. Membrane

Keyboards based upon capacitive technology

Keyboards based upon capacitive technology are usually more expensive and they resist dust and dirt better. The capacitive switch doesn't rely on metal contacts; it rather puts two plastic plates inside a switch hosing that is designed to sense changes in a circuit. Because of the enclosed housing and the lack of metal contacts, the capacitive switch is essentially collision free and immune to dust and dirt.

Mouse:

With the advent of graphical interfaces & graphical screens the mouse is used more then a keyboard.
Inside a mouse, two twin rollers are set at a right angle to each other. The rollers are attached to a notched wheel mechanism called an encoder. The rollers touch the rubberized ball; as the ball moves, friction turns the rollers and therefore the encoder.
The encoder wheels have very small notches on their edges and fine contact points where they touch the wall of the mouse. By calculating the number of times a contact is made from both encoders, the system can calculate where to put the pointer or cursor on the screen.

Fig 5.2 Mouse

The mouse is basically a case with a rolling ball underneath it. Once you move the case you move this rolling ball. Mice come in many different shapes but they all have essentially:

1. A case that fits in a hand
2. A roller ball that translates movement
3. Control buttons (usually 2, sometimes 3)

The mouse requires software (device driver), which tells the operating system or application how to relate the physical hardware movement to an on screen pointer. Sometimes you have to load up the drive where at other times it is already built into the operating system.

A basic mouse is mechanical in that the encoder's wheel and contacts are metal and make physical movements. There are two types of mice:

1. Optical
2. Optomechanical

An optical mouse has no moving parts and works in conjunction with a reflective mouse pad. As the mouse moves, a beam of light bounces from the inside of the casing to the reflective pad and then back onto a sensor to inside the mouse. The sensor calculates the changes in the light beam to define X-Y coordinates of the screen cursor.

The optomechanical mouse is a hybrid of mechanical versus optical mouse. The main difference lays in the fact that they have contacts with the encoder that uses a photo interrupter disk. The X-Y calculations are performed by counting the interruptions to a beam of light.

Scanner

Scanner is an input device that enables conversion of printed material into a machine-readable form.

Fig 5.3 Scanner

There is a very dense array of photocells placed at the top of the scanner. As long as the surface is white, these photocells send digital signals 0 which are continuously stored into a file.

As we start crossing the (black) line, data changes from 0 to 1.On the next line we get data 1 at a different position, and finally the resulting file can now be interpreted by another program, which will place a black dot on the screen, wherever there is a 1 in our file.

Notice that the resulting picture is just an approximation of the original one. However, keep in mind that a typical scanner has a resolution of 2400 dots per inch - in other words, dots are so small that their 'rough edges' are almost invisible. If there is ever a resolution problem, it can

usually be blamed on your monitor and/or printer. Of the three, scanner has by far the highest resolution.

Scanning pictures is easy. How about scanning text. It is important to understand that, at this point we still don't have a letter that could be readily used in a word processor. Instead we have a picture of a letter. If the above letter **'A'** was 1/10 th of an inch high and wide, and if our scanner was working at the 2,400 dpi (dots per inch) resolution, the resulting file would contain 240 x 240 zeros or ones. That is equal to 57600 bits or 7.2 Kb ! Here, we have a picture of the letter that is stored in 7,200 bytes. We can not effectively use pictures of letters; we have to convert them into codes. There is a special piece of software that does that; it is called **OCR (**optical character recognition) software.

Converting typed text from a clean sheet of paper yields almost 100% accuracy. As you might have imagined, converting handwritten text is not as simple. By using sophisticated pattern recognition algorithms handwritten text recognition accuracy can climb up to 99% (realize that this still means about one typo per line). However, if you cannot read your own handwriting, it's not likely that the computer will be able to do it either.

Microphone

Microphone is a device that we use for voice input. It converts audio waves into analog electrical signals. Since our computers can only work with digital signals, we need an analog to digital converter placed between a microphone and a PC. Inside a PC a program (or a piece of hardware) called digital signal processor performs a very complex analysis and converts incoming digital signals into words, which are either immediately used by an application or placed into a file.

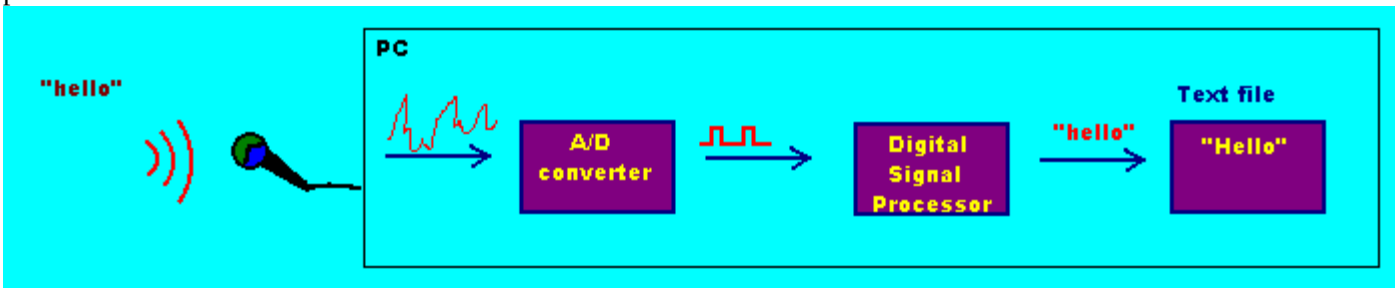

Fig 5.4 Working of a microphone

There are two basic types of voice input:

Despite all the hype, today's continuous speech recognizers are not really usable. They require you to speak in a slow constant-pitch, constant-volume voice. Most people can still type faster. You are particularly out of luck if you catch a cold. However, keep in mind that both hardware and software technology is changing very fast. Just because we do not have a good speech recognizer today, doesn't mean that we are not going to have one next year.

Touch Screen Devices

Touch sensitive screens try to make user's interaction with a computer a little bit more intuitive - you can use your finger as a 'pointing device'. There are several ways in which touch sensitive screens can detect pressure point coordinates:

Infrared screens generate a grid of invisible (infrared) light very close to the screen surface. Each light beam is detected on the opposite side of the screen. When the infrared light detector stops detecting light (because your finger interfered with it), an appropriate digital signal is sent to the screen driver program which interprets it as a set of (x,y) coordinates Those coordinates are then passed to the running application with takes the appropriate action.

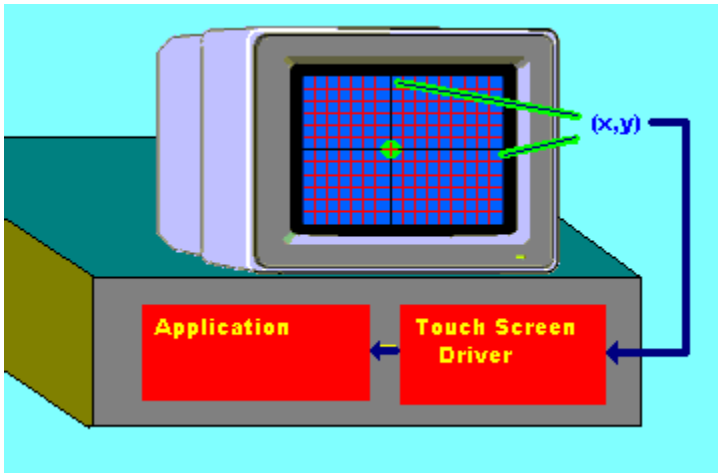

Fig: 5.4 Touch Screen Device

Pressure Sensitive Pad accomplishes the same task in a different manner. The pad has a pressure sensitive ribbon installed on its edges:

When a pressure sensitive pad is placed under the monitor, it can detect the place of pressure on the screen surface, because each screen pressure point will generate a different pressure pattern on the ribbon. Different pressure patterns will generate different (x,y) coordinates. The sensitivity of this device is very high - up to 1,000,000 points per screen. An advantage of pressure pad is that it can be easily moved from one computer to another. Its disadvantage is its high price.

Joystick

The basic idea of a joystick is to translate the movement of a plastic stick into electronic information a computer can process. Joysticks are used in all kinds of machines, including F-15 fighter jets and **wheelchairs**. In this article, we'll be focusing on computer joysticks, but the same principles apply to other sorts of joysticks.
The various joystick technologies differ mainly in how much information they pass on. The simplest joystick design, used in many early game consoles, is just a specialized electrical switch. It consists of a **stick**, which is attached to a **plastic base** with a flexible rubber sheath. The base houses a **circuit board** that sits directly underneath the stick. The circuit board is made up of several "printed wires," which connect to several **contact terminals**. Ordinary wires extend from these contact points to the computer. The printed wires form a simple electrical circuit made up of several smaller circuits. The circuits just carry electricity from one contact point to another. When the joystick is in the neutral position -- when you're not pushing one way or another -- all but one of the individual circuits are broken. The conductive material in each wire doesn't quite connect,

ectricity.

Fig : 5.5 Joystick

Light pen

is a device that enables better pressure point control then your finger does. Among other things, you can use it to 'draw' directly onto the screen. This feature can be used for direct handwritten text input.

Lightpen detects (x,y) coordinates of a pressure point by letting the CPU know when a picture generating electron beam passes under it. We will talk more about this when we start discussing monitors.

Fig 5.7 Light Pen

WebCam

A simple Webcam consists of a **digital camera** attached to your computer. Cameras like these have dropped well below $100 and they are easy to connect through a USB port (earlier cameras connected through a dedicated card or the parallel port). A piece of software connects to the camera and grabs a frame from it periodically. For example, the software might grab a still image from the camera once every 30 seconds. The software then turns that image into a normal JPG

Fig : 5.8 Web Camera

file and uploads it to your Web server. The JPG image can be placed on any Web page

In order for you to create a simple Web Cam, you need three things: A **camera** of some sort connected to your computer

1. A piece of **software** that can grab a frame from the camera periodically

2. A **Web server**

For some people, their home computer serves as their Web server. If that's the case, these three things are all that you need.

Multiple Choice Questions

21. Which is not a Input device.

a) Light Pen b) Key Board

c) Scanner d) Compact Disk

22. The Following is not a technology of switch keyboards .

a) Foam Element b) Membrane

c) Rubber Dome d) Electronic Foam

23. Following is not a type of technology available in Mouse

a) Mechanical b) Electrical

c) Optical d) Optomechanical

24. Webcam is useful for.

a) Video Chatting b) Remote Video

b) Searching the Internet c) Transferring the video

25. With Light Pen we can draw Directly on _____.

a) Any Surface b) Paper

c) table d) Screen

26. _____is an input device that enables conversion of printed material into a machine-readable form.

a) Light pen b) Scanner

c) WebCam d) Mouse

27. For A webcam we require

a) A camera b) A webserver

c) Software to install d) all the three

28. Pattern Recognition algorithms are used to read _____.

a) Typed material b) Printed Material

c) Hand written Material d) None of these

29. Microphone is a _____Input device.

a) Voice b) text

c) Pressure d) video

30. Capacitive technology Keyboards resist _____.

a) Moisture b) Pressure

b) dirt d) water

31.

a) Latency b) Average time

c) Seek time d) Access time

32. The storage capacity requirements of an individual are_____.

a) Decreasing b) constant

c) Increasing d) zero

33. Which is not a part of FDD.

a) stepper motor b) lens system

c) drive motor d) Mechanical Frame

34. Disk Transfer rate is_____.

a) time to transfer the disk
b) time to erase the data from the disk
d) time to replace the disk
d) time to transfer data to & from the disk

35. when certain data is required & data is found in the cache.
    a) Cache Hit
    b) RAM Hit
    c) Data Hit
    d) Memory Hit

36. Thumb drive is attached to _____.
    a) Serial Port
    b) USB Port
    c) Parallel Port
    d) Any of the three

37. DVD can store
    a) A full Video Movie
    b) Rich Multimedia
    c) Sophisticated Software Packages
    d) All the three

38. Wearable computers are
    a) The computers that has wheels
    b) The computer with a cloth
    b) Specific brand of a company
    d) The humans wearing computers

39. Joy Stick is not used in
    a) Playing games
    b) controlling Wheel Chairs
    c) Writing Software Programs
    d) controlling robots

40. Sophistication of input devices is
    a) Decreasing
    b) increasing
    c) Constant
    d) none of these

Review Questions

6. Explain the following terms

a) Light Pen

b) Web Cam

c) Capacitive Keyboards

7. Compare the various keyboard mechanisms .
8. Explain the working of the input devices attached to your computer.
9. How speech recognition system works.
10. Explain the working of various types of mouse.

Discussion questions

4. With the coming of wireless computing how the input devices are changing.

5. How we can escape from the input gadgets & start using our voice & vision as the input device.

6. Explore the working of WebCam & the numerous application of WebCam in our daily life.

Answers to Multiple Choice Questions:

21. c
22. a
23. d
24. a
25. d
26. a
27. c
28. b
29. d
30. d
31. b
32. c
33. b
34. d
35. c
36. d
37. d
38. d
39. b

40. b