Display Devices

- **Flat panel displays** encompass a growing number of electronic visual display technologies.
- They are far lighter and thinner than traditional television sets and video displays that use cathode ray tubes (CRTs)
- Types of FPD
    1. Volatile Display
    2. Static Display

Volatile FPD

- Volatile displays require pixels be periodically refreshed to retain their state, even for a static image. This refresh typically occurs many times a second. If this is not done, the pixels will gradually lose their coherent state, and the image will "fade" from the screen.
- **Examples of volatile flat panel displays**
    - Plasma displays
    - Liquid crystal displays (LCDs)
    - Organic light-emitting diode displays (OLEDs)
    - Light-emitting diode display (LED)
    - Electroluminescent displays (ELDs)
    - Surface-conduction electron-emitter displays (SEDs)
    - Field emission displays (FEDs) (also called **Nano-emissive displays** (NEDs))

Static FPD

- Static flat panel displays rely on materials whose color states are bistable.
- This means that the image they hold requires no energy to maintain, but instead requires energy to change.
- This results in a much more energy-efficient display, but with a tendency towards slow refresh rates which are undesirable in an interactive display.
- Bistable flat panel displays are beginning deployment in limited applications (Cholesteric displays, manufactured by Magink, in outdoor advertising; electrophoretic displays in e-book products from Sony and iRex; anlabels).
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Input Technology

- In computing, an **input device** is a peripheral (piece of computer hardware equipment) used to provide data and control signals to aninformation processing system such as a computer or information appliance.
- Examples of input devices include keyboards, mouse,scanners, digital cameras and joysticks.
- Many input devices can be classified according to:
    - modality of input (e.g. mechanical motion, audio, visual, etc.)
    - whether the input is discrete (e.g. key presses) or continuous (e.g. a mouse's position, though digitized into a discrete quantity, is fast enough to be considered continuous)
    - the number of degrees of freedom involved (e.g. two-dimensional traditional mice, or three-dimensional navigators designed for CADapplications)

Touch Screens

- A **touch screen** is an input device normally layered on the top of an electronic visual display of an information processing system.
- A user can give input or control the information processing system through simple or multi-touch gestures by touching the screen with a special stylus and/or one or more fingers.
- The user can use the touchscreen to react to what is displayed and to control how it is displayed; for example, zooming to increase the text size.
- The touch screen enables the user to interact directly with what is displayed, rather than using a mouse, touchpad, or any other intermediate device (other than a stylus, which is optional for most modern touchscreens).

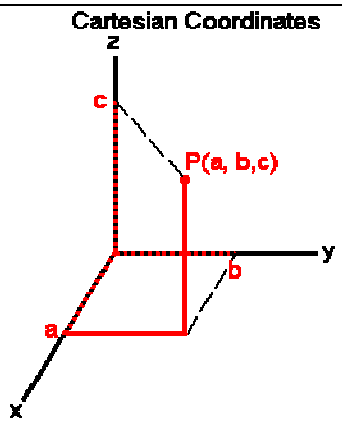
- There are a variety of touch screen technologies with different methods of sensing touch:
  - Resistive
  - Surface acoustic wave
  - Capacitive
  - Surface capacitance
  - Projected capacitance
  - Infrared grid
  - Optical imaging
  - Dispersive signal technology
  - Acoustic pulse recognition

Co-ordinate System

- Framework to define position in 2D or 3D
- Use of co-ordinates that are distances from
  - A set of reference planes
  - Angles subtended with an origin
  - Or both
- Types
  - Cartesian
  - Polar
  - Spherical
  - Cylindrical
  -

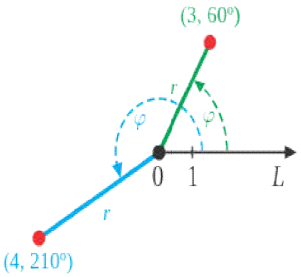
Cartesian Co-ordinate system

- Cartesian coordinates, also called rectangular coordinates
- The Cartesian plane consists of two perpendicular axes that cross at a central point called the origin.
- Positions or coordinates are determined according to the *east/west* and*north/south* displacements from the origin.
- The east/west axis is often called the *x* axis, and the north/south axis is called the *y* axis.
- For this reason, the Cartesian plane is also known as the *xy* -plane.
- The *x* and *y* axes are linear number lines, meaning that each division on a given axis always represents the same increment.
- In a 3D Cartesian coordinate system, a point P is referred to by three real numbers (coordinates), indicating the positions of the perpendicular projections from the point to three fixed, perpendicular, graduated lines, called the **axes** which intersect at the **origin**



Polar Coordinate System

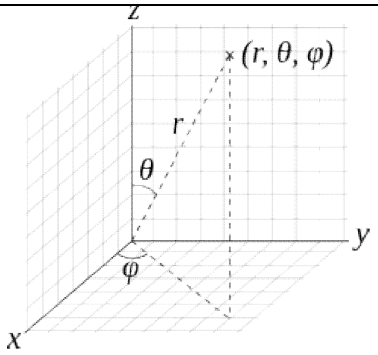
- In mathematics, the **polar coordinate system** is a two-dimensional coordinate system in which each point on a plane is determined by a distance from a reference point and an angle from a reference direction.
- The reference point (analogous to the origin of a Cartesian system) is called the *pole*, and the ray from the pole in the reference direction is the *polar axis*. The distance from the pole is called the *radial coordinate* or *radius*, and the angle is called the *angular coordinate*, *polar angle*, or *azimuth*



Points in the polar coordinate system with pole *O* and polar axis *L*.
In green, the point with radial coordinate 3 and angular coordinate 60 degrees or (3,60°).
In blue, the point (4,210°).

Spherical Coordinate System

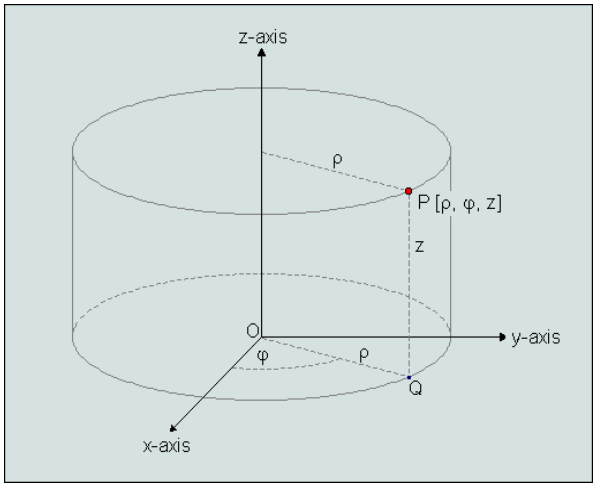
- **Spherical coordinate system** is a coordinate system for three-dimensional space where the position of a point is specified by three numbers:
  1. the **radial distance** of that point from a fixed origin,
  2. its **polar angle** measured from a fixed zenithdirection, and
  3. the **azimuth angle** of its orthogonal projection on a reference plane that passes through the origin and is orthogonal to the zenith, measured from a fixed reference direction on that plane.
- It can be seen as the three-dimensional version of the polar coordinate system.



Spherical coordinates (*r*, *ϑ*, *φ*) radial distance*r*, polar angle *ϑ* (theta), and azimuthal angle *φ* (phi).

Cylindrical coordinate system

- A **cylindrical coordinate system** is a three-dimensional coordinate system that specifies point positions by
  1. the distance from a chosen reference axis,
  2. the direction from the axis relative to a chosen reference direction, and
  3. the distance from a chosen reference plane perpendicular to the axis.
- The latter distance is given as a positive or negative number depending on which side of the reference plane faces the point.



A cylindrical coordinate system with

- **origin *O*,**
- **polar axis *A*, and**
- **longitudinal axis *L*.**

The dot is the point with

- **radial distance*ρ* = 4,**
- **angular coordinate *φ* = 130°, and**
- **height *z* = 4.**