Graphics input devices

Keyboards

- Keyboards are used as entering text strings. It is efficient devices for inputting such a non-graphics data as picture label.
- Cursor control key's & function keys are common features on general purpose keyboards.
- Many other application of key board which we are using daily used of computer graphics are commanding & controlling through keyboard etc.

Mouse

- Mouse is small size hand-held box used to position screen cursor.
- Wheel or roller or optical sensor is directing pointer on the according to movement of mouse.
- Three buttons are placed on the top of the mouse for signaling the execution of some operation.
- Now a day's more advance mouse is available which are very useful in graphics application for example Z mouse.

Trackball and Spaceball

- Trackball is ball that can be rotated with the finger or palm of the hand to produce cursor movement.
- Potentiometer attached to the ball, measure the amount and direction of rotation.
- They are often mounted on keyboard or Z mouse.
- Space ball provide six-degree of freedom i.e. three dimensional.
- In space ball strain gauges measure the amount of pressure applied to the space ball to provide input for spatial positioning and orientation as the ball is pushed or pulled in various directions.
- Space balls are used in 3D positioning and selection operations in virtual reality system, modeling, animation, CAD and other application.

Joysticks

- A joy stick consists of small vertical lever mounted on a base that is used to steer the screen cursor around.
- Most joy sticks selects screen positioning according to actual movement of stick (lever).
- Some joy sticks are works on pressure applied on sticks.
- Sometimes joy stick mounted on keyboard or sometimes used alone.
- Movement of the stick defines the movement of the cursor.
- In pressure sensitive stick pressure applied on stick decides movement of the cursor. This pressure is measured using strain gauge.
- This pressure sensitive joy sticks also called as isometric joy sticks and they are non movable sticks.

Data glove

- Data glove is used to grasp virtual objects.
- The glow is constructed with series of sensors that detect hand and figure motions.
- Electromagnetic coupling is used between transmitter and receiver antennas which used to provide position and orientation of the hand.
- Transmitter & receiver Antenna can be structured as a set of three mutually perpendicular coils forming 3D Cartesian coordinates system.
- Input from the glove can be used to position or manipulate object in a virtual scene.

Digitizer

- Digitizer is common device for drawing painting or interactively selecting coordinates position on an object.
- One type of digitizers is graphics tablet which input two dimensional coordinates by activating hand cursor or stylus at selected position on a flat surface.
- Stylus is flat pencil shaped device that is pointed at the position on the tablet.

Image Scanner

- Image Scanner scan drawing, graph, color, & black and white photos or text and can stored for computer processing by passing an optical scanning mechanism over the information to be stored.
- Once we have internal representation of a picture we can apply transformation.
- We can also apply various image processing methods to modify the picture.
- For scanned text we can apply modification operation.

Touch Panels

- As name suggest Touch Panels allow displaying objects or screen-position to be selected with the touch or finger.
- A typical application is selecting processing option shown in graphical icons.
  - Some system such as a plasma panel are designed with touch screen
  - Other system can be adapted for touch input by fitting transparent touch sensing mechanism over a screen.
  - Touch input can be recorded with following methods.
    1. Optical methods
    2. Electrical methods
    3. Acoustical methods

Optical method

- Optical touch panel employ a line of infrared LEDs along one vertical and one horizontal edge.
- The opposite edges of the edges containing LEDs are contain light detectors.
- When we touch at a particular position the line of light path breaks and according to that breaking line coordinate values are measured.
- In case two line cuts it will take average of both pixel positions.
- LEDs operate at infrared frequency so it cannot be visible to user.

Electrical method

- An electrical touch panel is constructed with two transparent plates separated by small distance.
- One is coated with conducting material and other is coated with resistive material.
- When outer plate is touch it will come into contact with internal plate.
- When both plates touch it creates voltage drop across the resistive plate that is converted into coordinate values of the selected position.

Acoustical method

- In acoustical touch panel high frequency sound waves are generated in horizontal and vertical direction across a glass plates.
- When we touch the screen the waves from that line are reflected from finger.
- These reflected waves reach again at transmitter position and time difference between sending and receiving is measure and converted into coordinate values.

Light pens

- Light pens are pencil-shaped device used to select positions by detecting light coming from points on the CRT screen.
- Activated light pens pointed at a spot on the screen as the electron beam lights up that spot and generate electronic pulse that causes the coordinate position of the electron beam to be recorded.

Voice systems

- It is used to accept voice command in some graphics workstations.
- It is used to initiate graphics operations.
- It will match input against predefined directory of words and phrases.
- Dictionary is setup for a particular operator by recording his voice.
- Each word is speak several times and then analyze the word and establishes a frequency pattern for that word along with corresponding function need to be performed.
- When operator speaks command it will match with predefine dictionary and perform desired action.

Interactive picture construction techniques, Computer Graphics

Explain the interactive picture construction techniques. interactive picture- construction methods are commonly used in variety of applications, including design and painting packages. These methods provide user with the capability to position objects, to constrain fig. to predefined orientations or alignments, to sketch fig., and to drag objects around the screen. Grids, gravity fields, and rubber band methods are used to aid in positioning and other picture construction operations. The several techniques used for interactive picture construction that are incorporated into graphics packages are:

(1) Basic positioning methods:- coordinate values supplied by locator input are often used with positioning methods to specify a location for displaying an object or a character string. Coordinate positions are selected interactively with a pointing device, usually by positioning the screen cursor.

(2) constraints:-A constraint is a rule for altering input coordinates values to produce a specified orientation or alignment of the displayed coordinates. the most common constraint is a horizontal or vertical alignment of straight lines.

(3) Grids:- Another kind of constraint is a grid of rectangular lines displayed in some part of the screen area. When a grid is used, any input coordinate position is rounded to the nearest intersection of two grid lines.

(4) Gravity field:- When it is needed to connect lines at positions between endpoints, the graphics packages convert any input position near a line to a position on the line. The conversion is accomplished by creating a gravity area around the line. Any related position within the gravity field of line is moved to the nearest position on the line. It illustrated with a shaded boundary around the line.

(5) Rubber Band Methods:- Straight lines can be constructed and positioned using rubber band methods which stretch out a line from a starting position as the screen cursor.

(6) Dragging:- This methods move object into position by dragging them with the screen cursor.

(7) Painting and Drawing:- Cursor drawing options can be provided using standard curve shapes such as circular arcs and splices, or with freehand sketching procedures. Line widths, line styles and other attribute options are also commonly found in painting and drawing packages.

Rubber Band Techniques

Rubber banding is a popular technique of drawing geometric primitives such as line, polylines, rectangle, circle and ellipse on the computer screen.

It becomes an integral part and de facto standard with the graphical user interface (GUI) for drawing and is almost universally accepted by all windows based applications.

The user specifies the line in the usual way by positioning its two endpoints. As we move from the first endpoint to the second, the program displays a line from the first endpoint to the cursor position, thus he can see the lie of the line before he finishes positioning it.

The effect is of an elastic line stretched between the first endpoint and the cursor; hence the name for these techniques.

Consider the different linear structures in fig (a) and fig (d), depending on the position of the cross-hair cursor. The user may move the cursor to generate more possibilities and select the one which suits him for a specific application.

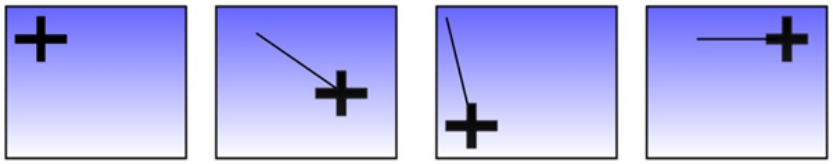


Fig:Demonstration of rubber banding: look at the cross-hair cursor(a) The start point of the line to be drawn is selected (b) 3 different lines are shown depending on the position of the cursor representing the end-point the user selects the desired line.

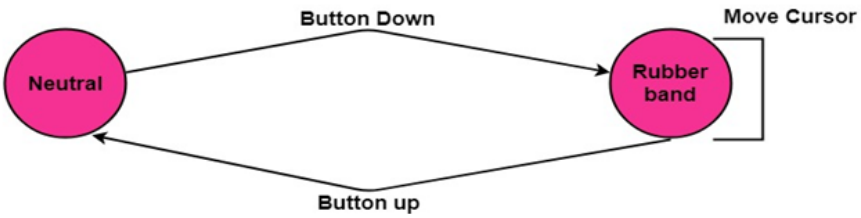
Selection of Terminal Point of the Line:

The user moves the cursor to the appropriate position and selects.

Then, as the cursor is moved, the line changes taking the latest positions of the cursors as the end-point.

As long as the button is held down, the state of the rubber band is active.

The process is explained with the state transition diagram of rubber banding in fig:



When the user is happy with the final position, the pressed button is released, and the line is drawn between the start and the last position of the cursor.

Example: This is widely followed in MS-Window based Applications like in the case of a paintbrush drawing package.

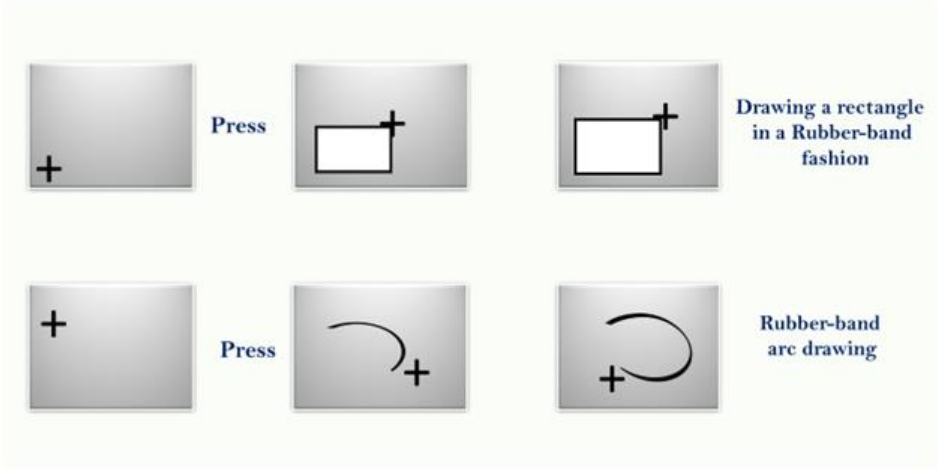
Other geometric entities can be drawn in a rubber-band fashion:

- Horizontally or vertically constructed lines

- Rectangles

- Arcs of circles

This technique is very helpful in drawing relatively complex entities such as rectangles and arcs.



Advantage:

1. It is used for drawing all geometric entities such as line, polygon, circle, rectangle, ellipse, and other curves.
2. It is easy to understand and implement.

Disadvantage:

1. It requires computational resources like software and CPU speed.
2. Expensive

Dragging

Dragging is used to move an object from one position to another position on the computer screen. To drag any other object, first, we have to select the object that we want to move on the screen by holding the mouse button down. As cursor moved on the screen, the object is also moved with the cursor position. When the cursor reached the desired position, the button is released.

The following diagram represents the dragging procedure: