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Programming in C

I semester, BCA

Ambition Guru College

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Unit 8

(3 hrs.)

Introduction to Graphics

- Modes, Initialization, Graphics Function

- **Graphics** in computer programming refers to the creation, manipulation, and display of visual images such as lines, shapes, and colors on a screen using code.
- Graphics transforms data into a visual format that is easy to understand and interact with.

Applications

1. Games development – To create interactive environments and characters
2. Graphical User Interface (GUI) – For designing user-friendly software interfaces
3. Animation and multimedia – Used in movies, cartoons, and presentations
4. Computer-Aided Design (CAD) – In engineering and architecture
5. Data visualization and image processing – Charts, graphs, dashboards, Editing images
6. Simulations – In training, flight simulators, virtual reality

- The **graphics.h** header file provides predefined functions to perform graphic operations like drawing shapes (lines, circles, rectangles), setting colors, filling areas, and managing the graphical screen. It is mainly used in Turbo C/C++ for creating basic 2D graphics.

Examples of functions in graphics.h:

- `initgraph()`
- `line()`
- `circle()`
- `setcolor()`
- `closegraph()`

Graphics: Concept of Coordinate System

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In C graphics, the screen follows a 2D Cartesian coordinate system, but with a slight change:

- Origin (0,0) is at the top-left corner of the screen.
- The X-axis increases to the right.
- The Y-axis increases downward.

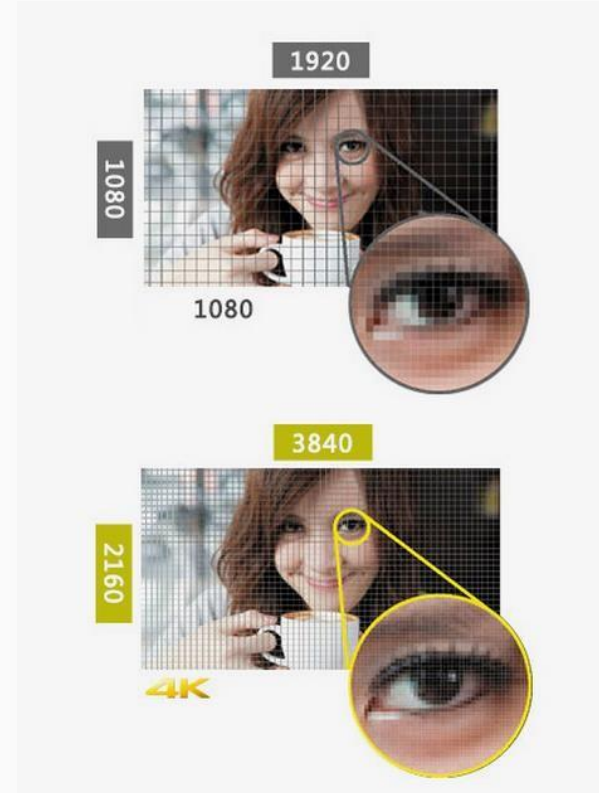
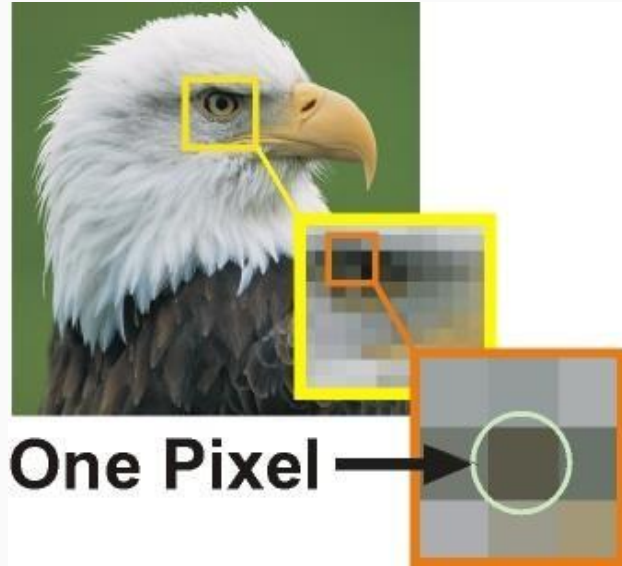
For example:

- The point (100, 100) is 100 pixels to the right and 100 pixels down from the top-left corner.
- The bottom-right corner depends on the resolution, e.g., in 640×480 mode, it is (639, 479).

- **Pixels:** A pixel is a short form of picture element and it represents a single point in a graphic image. More pixels = **higher resolution** = better image quality
- **Resolution:** The number of pixels used on the screen is called resolution.
- **Color:** In graphics, color defines the appearance of a pixel. The number of colors a pixel can display depends on the color depth (bits per pixel):
 - ✓ 1-bit: 2 colors (black and white)
 - ✓ 4-bit: 16 colors
 - ✓ 8-bit: 256 colors
 - ✓ 16-bit or 24-bit: Thousands to millions of colors

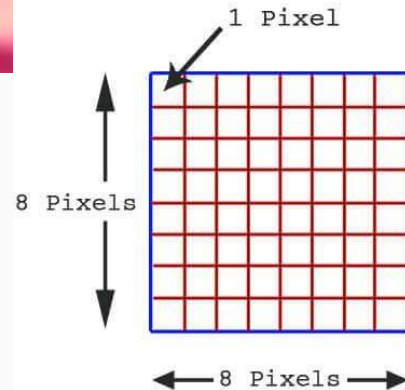
Graphics: Pixel

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Graphics: Resolution

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Standard way of writing Resolution

Resolution = 8 x 8 Pixels

= 64 Pixels

Actual total Resolution

Graphics mode and Initialization

Graphics mode and Initialization

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A **graphics mode** is a display setting where the screen can show images, shapes, and colors (unlike text mode, which only shows characters).

Graphics mode defines:

- The screen resolution (e.g., 640×480, 800×600)
- The number of colors
- The type of graphics driver (like VGA, EGA, etc.

Initializing Graphics in C

To use graphics in C, you must initialize the graphics system using `initgraph()` function, which sets up the graphics mode and driver.

Graphics mode and Initialization

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Initializing Graphics in C

Syntax of `initgraph()`

```
initgraph(&graphicsDriver, &graphicsMode, "BGI path");
```

`graphicsDriver`: Integer variable, usually set to `DETECT` (lets compiler auto-detect driver)

`graphicsMode`: Integer variable that stores the mode selected

"BGI path": Path to the BGI (Borland Graphics Interface) folder (e.g., "C:\\Turboc3\\BGI")

Initializing Graphics in C

```
#include <graphics.h>
#include <conio.h>

int main() {
    int gd = DETECT, gm;

    initgraph(&gd, &gm, ""); // No need for BGI path in WinBGIm
    outtext("Graphics Mode Initialized!");
    circle(200, 200, 50);    // Draw a circle
    getch();                 // Wait for key press
    closegraph();            // Close graphics mode
    return 0;
}
```

Basic Graphics functions in C

Basic Graphics functions in C

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Function	Description
<code>initgraph()</code>	Initializes graphics mode
<code>line(x1, y1, x2, y2)</code>	Draws a line from (x1, y1) to (x2, y2)
<code>rectangle(x1, y1, x2, y2)</code>	Draws a rectangle using two corner points
<code>circle(x, y, radius)</code>	Draws a circle with center (x, y) and radius
<code>ellipse(x, y, stangle, endangle, xradius, yradius)</code>	Draws an ellipse
<code>arc(x, y, start_angle, end_angle, radius)</code>	Draws an arc
<code>setcolor(color)</code>	Sets the outline color for shapes
<code>setbkcolor(color)</code>	Sets the background color
<code>setfillstyle(style, color)</code>	Sets pattern and fill color
<code>floodfill(x, y, border_color)</code>	Fills an area with color
<code>closegraph()</code>	Closes the graphics mode

Basic Graphics functions in C

```
#include <graphics.h>
#include <conio.h>

int main() {
    int gd = DETECT, gm;
    initgraph(&gd, &gm, ""); // For Dev-C++ with WinBGIm

    // Set background color
    setbkcolor(WHITE);
    cleardevice(); // Apply background

    // Draw a line
    setcolor(BLUE);
    line(100, 100, 300, 100);

    // Draw rectangle
    setcolor(RED);
    rectangle(100, 150, 300, 250);

    // Draw filled circle
    setfillstyle(SOLID_FILL, GREEN);
    circle(200, 350, 50);
    floodfill(200, 350, GREEN); // Fill the circle

    // Draw ellipse
    setcolor(MAGENTA);
    ellipse(200, 450, 0, 360, 100, 30);

    // Draw arc
    setcolor(BROWN);
    arc(200, 550, 0, 180, 50);

    getch(); // Wait for user input
    closegraph(); // Close graphics mode
    return 0;
}
```

Basic Graphics functions in C : Draw a circle

```
#include <graphics.h>
#include <conio.h>

int main() {
    int gd = DETECT, gm;

    initgraph(&gd, &gm, "");

    // Set color and draw a circle
    setcolor(BLUE);
    circle(200, 200, 100); // center (200, 200), radius 100

    getch();
    closegraph(); // Close the graphics mode
    return 0;
}
```


Questions:

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1. What is the purpose of the `initgraph()` function in C/C++ graphics programming?
2. Write the syntax and purpose of the `line()` and `rectangle()` functions.
3. What is the difference between `setcolor()` and `setbkcolor()` in graphics?
4. List any four functions used to draw shapes in graphics programming.
5. Name two header files necessary for using graphics in C/C++.
6. Explain the different graphics modes and how graphics are initialized in C/C++ programming. Also, write a program to initialize the graphics mode.
7. Describe various graphics functions available in the `graphics.h` library. Give suitable examples of any three functions.

THANK YOU
Any Queries ?