

United Technical College, Bharatpur, Chitwan

Lab1

Date Assigned: Nov 29, 2022

Date Due: Dec 06, 2022

Digital Differential Analyzer (DDA) Algorithm

Digital Differential Analyzer (DDA) Algorithm is used for linear interpolation of variables over an interval between given start, end points and for rasterization of lines, triangles and polygons. Using DDA Algorithm, Write a C-Program to draw a line segment between two given points.

Aim: To implement DDA Algorithm for drawing a line segment between two given end points $A(x_1, y_1)$ and $B(x_2, y_2)$.

Description: DDA algorithm is an incremental scan conversion method. Here we perform calculations at each step using the results from the preceding step. The characteristic of the DDA algorithm is to take unit steps along one coordinate and compute the corresponding values along the other coordinate. The unit steps are always along the coordinate of greatest change, e.g. if $dx = 10$ and $dy = 5$, then we would take unit steps along x and compute the steps along y . In DDA we need to consider two cases; One is slope of the line less than or equal to one ($|m| \leq 1$) and slope of the line greater than one ($|m| > 1$).

- When $|m| \leq 1$ means $y_2 - y_1 = x_2 - x_1$ or $y_2 - y_1 < x_2 - x_1$ and therefore we assume x to be the major axis. Here we sample x axis at unit intervals and find the y values corresponding to each x value. We have the slope equation as

$$\Delta y = m \Delta x$$

$$y_2 - y_1 = m (x_2 - x_1)$$

$$\text{so, } x_{k+1} = x_k + 1 \text{ and } y_{k+1} = y_k + m$$

- When $|m| > 1$ means $y_2 - y_1 > x_2 - x_1$ and therefore we assume y to be the major axis. Here we sample y axis at unit intervals and find the x values corresponding to each y value. We have the slope equation as

$$\Delta y = m \Delta x$$

$$y_2 - y_1 = m (x_2 - x_1)$$

$$\text{so, } y_{k+1} = y_k + 1 \text{ and } x_{k+1} = x_k + 1/m$$

DDA Algorithm

Step1: Start

Step2: Read two end points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$

Step3: Calculate $dx = x_2 - x_1$
 $dy = y_2 - y_1$

Step4: calculate slope $m = dy/dx$

Step5: if $\text{abs}(m) < 1$

$$y = y_1$$

for ($x = x_1$; $x \leq x_2$; $x++$)

$$y = y + m$$

United Technical College, Bharatpur, Chitwan

```

    plot the pixel position with specified color: setPixel(x, round(y))
else if abs(m>1)
    for (y=y1; y<=y2; y++)
        x = x+1/m
    plot the pixel position with specified color: setPixel(round(x), y)

else
    for(x=x1; x<=x2; x++)
        x = x+1;
        y = y+1;
    plot the pixel position with specified color: putpixel(round(x),round(y))

```

Step6: Close the graph and Stop.

DDA Algorithm C Program: Students are expected to write codes for DDA line drawing algorithm in lab.

Basic Structure of a C-graphics program:

```

#include<stdio.h>
#include<graphics.h> //must be included for every graphics program
#include<conio.h>
#include<dos.h> //for including delay function.
void main(){
int gd=DETECT, gm; //gd=detects best available graphics driver, gm =graphics mode.
initgraph(&gd,&gm,"C:\\\\TurboC3\\\\BGI"); // for initializing graph mode
// above 2 steps are must for every graphics program.
//declaration of any variables must be done before calling initgraph() function.// next write code for
producing requiring design or drawing object.
line(100,100,200,200); //draws a line segment.
getch(); }

```

OUTPUT:

