PUNE INSTITUTE OF COMPUTER TECHNOLOGY

IT Department

CGL Assignment 3

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Title:

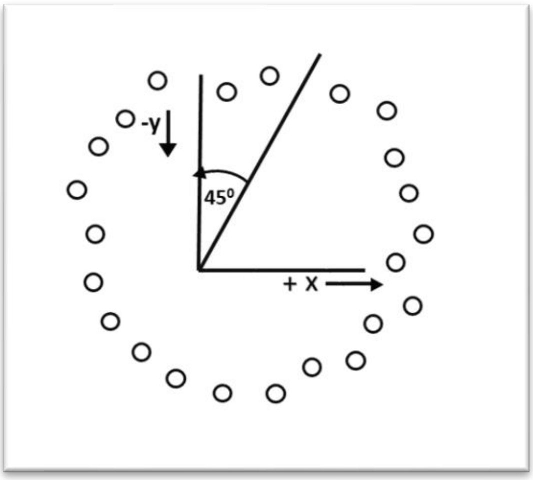
Implement Bresenham circle drawing algorithm to draw any object. The object should be displayed in all the quadrants with respect to center and radius

Problem Statement:

Implement Bresenham circle drawing algorithm to draw any object. The object should be displayed in all the quadrants with respect to center and radius

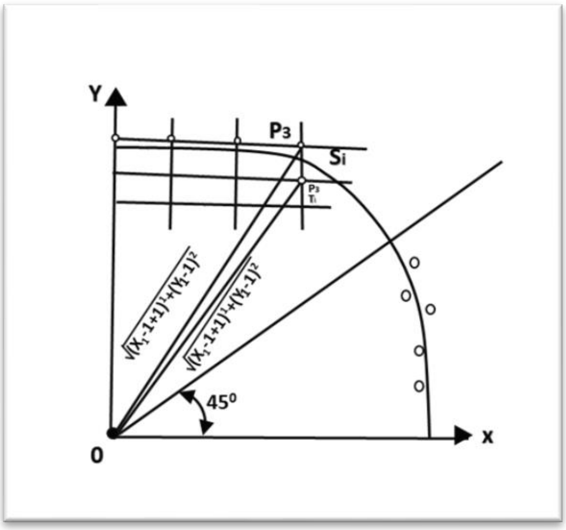
Theory:

Scan-Converting a circle using Bresenham's algorithm works as follows: Points are generated from 90° to 45°, moves will be made only in the +x & -y directions as shown in fig:



The best approximation of the true circle will be described by those pixels in the raster that falls the least distance from the true circle. We want to generate the points from 90° to 45°. Assume that the last scan-converted pixel is P_1 as shown in fig.

Each new point closest to the true circle can be found by taking either of two actions.

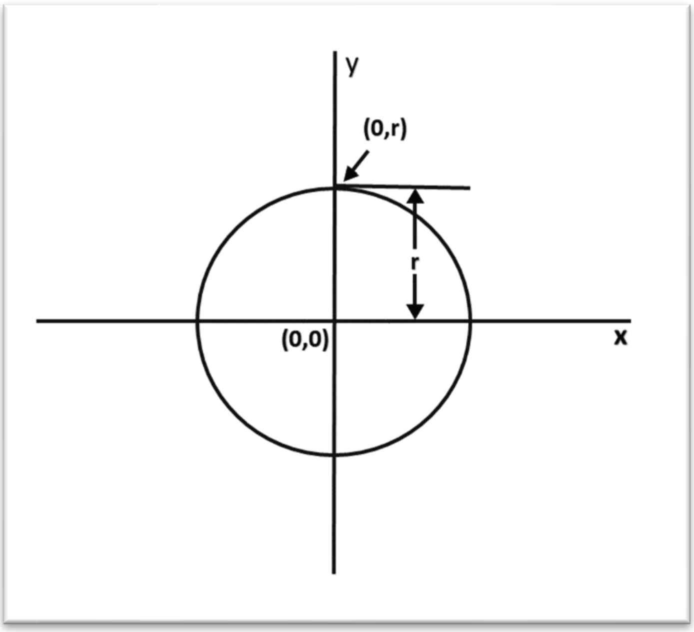


1. Move in the x-direction one unit or
2. Move in the x- direction one unit & move in the negative y-direction one unit.

Let D (S_i) is the distance from the origin to the true circle squared minus the distance to point P_3 squared. D (T_i) is the distance from the origin to the true circle squared minus the distance to point P_2 squared. Therefore, the following expressions arise.

$$\mathbf{D(S_i)=(x_{i-1}+1)^2+y_{i-1}^2-r^2}$$
$$\mathbf{D(T_i)=(x_{i-1}+1)^2+(y_{i-1}-1)^2-r^2}$$

Since D (S_i) will always be +ve & D (T_i) will always be -ve, a decision variable d may be defined as follows:



$d_i=D(S_i)+D(T_i)$

Therefore,
$d_i=(x_{i-1}+1)^2+y_{i-1}^2-r^2+(x_{i-1}+1)^2+(y_{i-1}-1)^2-r^2$

From this equation, we can drive initial values of d_i as

If it is assumed that the circle is centered at the origin, then at the first step x = 0 & y = r.

Therefore,

$$d_i=(0+1)^2+r^2-r^2+(0+1)^2+(r-1)^2-r^2$$
$$=1+1+r^2-2r+1-r^2$$
$$=3-2r$$

Thereafter, if d_i<0,then only x is incremented.

$x_{i+1}=x_{i+1}$ $\quad d_{i+1}=d_i+4x_i+6$

& if $d_i\geq 0$,then x & y are incremented

$x_{i+1}=x_{i+1}$ $\quad y_{i+1}=y_i+1$

$d_{i+1}=d_i+4(x_i-y_i)+10$

Algorithm:

Step1: Start Algorithm

Step2: Declare p, q, x, y, r, d variables
p, q are coordinates of the center of the circle
r is the radius of the circle

Step3: Enter the value of r

Step4: Calculate d = 3 - 2r

Step5: Initialize x=0
&nbsy= r

Step6: Check if the whole circle is scan converted
If x > = y
Stop

Step7: Plot eight points by using concepts of eight-way symmetry.

The center is at (p, q). Current active pixel is (x, y).
putpixel (x+p, y+q)
putpixel (y+p, x+q)
putpixel (-y+p, x+q)
putpixel (-x+p, y+q)

putpixel (-x+p, -y+q)
putpixel (-y+p, -x+q)
putpixel (y+p, -x+q)
putpixel (x+p, -y-q)

Step8: Find location of next pixels to be scanned

If $d < 0$

then $d = d + 4x + 6$

increment $x = x + 1$

If $d \geq 0$

then $d = d + 4 (x - y) + 10$

increment $x = x + 1$

decrement $y = y - 1$

Step9: Go to step 6

Step10: Stop Algorithm

Conclusion:

Learned to implement Bresenham's circle drawing algorithm

Advantages

- It is a simple algorithm.
- It can be implemented easily
- It is totally based on the equation of circle i.e. $x^2 + y^2 = r^2$

Disadvantages

- There is a problem of accuracy while generating points.
- This algorithm is not suitable for complex and high graphic images.