CSO351: Computer Graphics

Lab Assignment 2.Ellipse.(b):
Ellispe Generation using Polynomial Equation

Objective:

Write a program in C/C++ for implementation of ellipse generation using polynomial equation.

Algorithm:

- **Step 1:** Set the initial variables: a = length of major axis; b = length of minor axis; coordinates of ellipse center (h, k); initially x = 0; x_{end} = a.
- **Step 2:** Consider for first quadrat. Iterate from x = 0 and stop at x = a.
- **Step 3:** Compute the value of the y coordinate for each x coordinate:

$$y = b[1 - (x/a)^2]^{1/2}$$

- **Step 4:** Plot the four points, found by symmetry, at the current (x, y) coordinates:

```
Plot (x + h, y + k)
Plot (-x + h, y + k)
Plot (-x + h, -y + k)
Plot (x + h, -y + k)
```

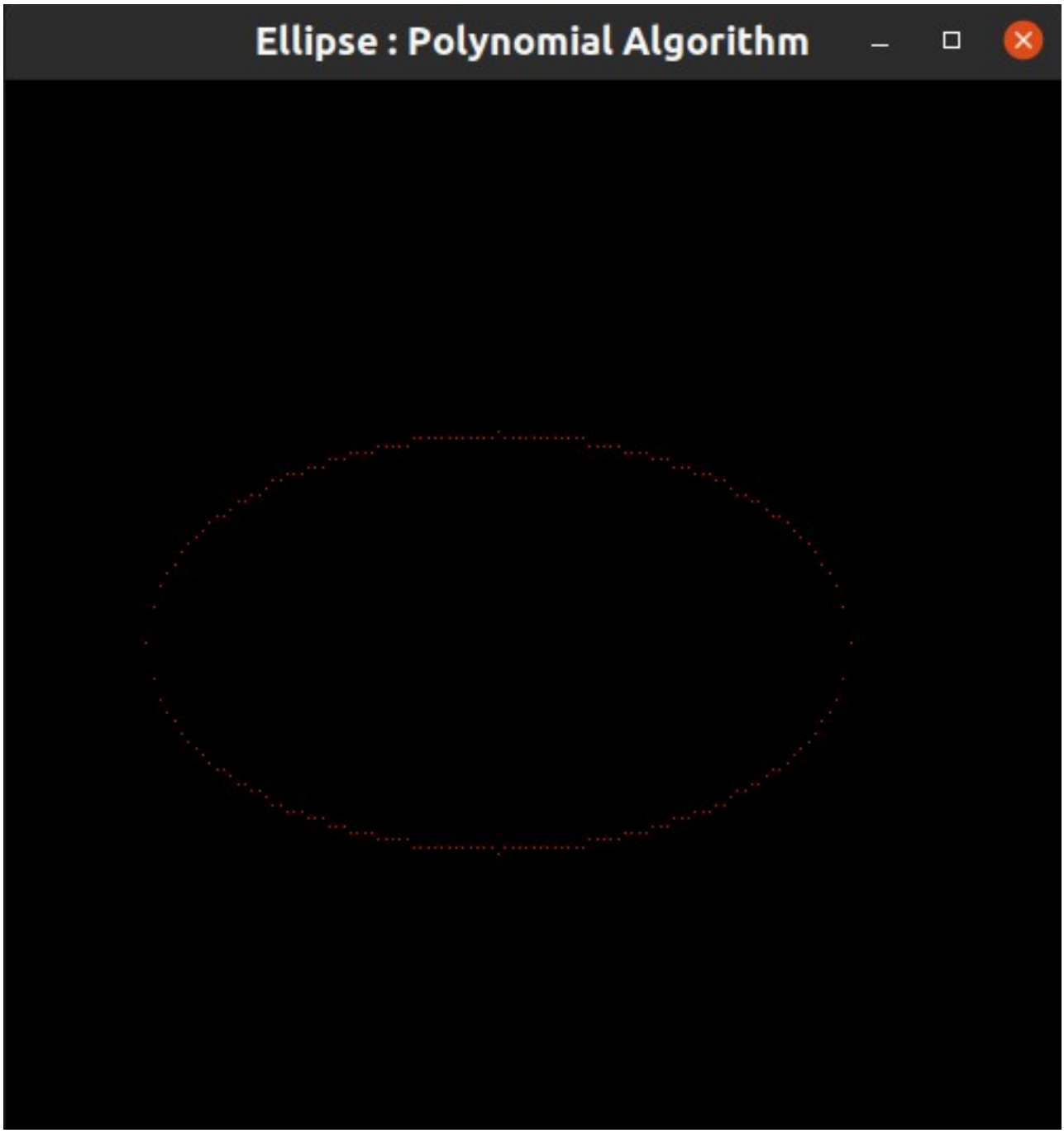
- **Step 5:** Increment x by 1.
- **Step 6:** Repeat steps 3 to 5 until x reaches a.

Result:

Input:

```
swaraj@shiv-raj-75:~/Documents/Assignments/Sem5/CG$ ./2.ellipse.b
Enter the center: 20 20
Enter major and minor axes: 50 30
```

Output:



Conclusion:

- It is time consuming method.
- Ellipse generated is not smooth and some minor discontinuities occur when x reaches a.

Appendix: Code

```
#include <stdio.h>
#include <iostream>
#include <GL/glut.h>
#include <cmath>

using namespace std;
int h, k, a, b;

void init(void)
{
    glClearColor(0.0, 0.0, 0.0, 0.0);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluOrtho2D(-50, 100, -50, 100);
}

void plot(int x, int y)
{
    glBegin(GL_POINTS);
    glVertex2i(x+h, y+k);
    glEnd();
}

void ellipse()
{
    int x = 0;
    double y = b;
    plot(x,y);
    plot(x,-y);
    x++;
    while (x <= a)
    {
        y = b * sqrt(((a*a)-(x*x*1.0))/(a*a));
        round(y);
        plot(x,y);
        plot(-x,y);
        plot(-x,-y);
        plot(x,-y);
        x++;
    }
}
```

```
void display(void)
{
    glClear (GL_COLOR_BUFFER_BIT);
    glColor3f (1.0, 0.0, 0.0);
    glPointSize(1.0);
    ellipse ();
    glFlush ();
}

int main(int argc, char** argv)
{
    cout << "Enter the center: ";
    cin >> h >> k;
    cout << "Enter major and minor axes: ";
    cin >> a >> b;
    glutInit(&argc, argv);
    glutInitDisplayMode (GLUT_SINGLE | GLUT_RGB);
    glutInitWindowSize (500, 500);
    glutInitWindowPosition (0, 0);
    glutCreateWindow ("Ellipse : Polynomial Algorithm");
    glutDisplayFunc(display);
    init ();
    glutMainLoop();
    return 0;
}
```