COSC 4370

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1 Problem

The assignment requires the rasterization of an ellipse (x/12) ^2 + (y/6) ^2 = 64^2 where y ≥ 0. There is no fixed radius of the ellipse, and the given image dimension is 200 x 200.

2 Method

The function set_pixel() was the only thing modified in the provided code. This function takes in six parameters of data type integer: x0, y0, an 8-bit blue value scale, an 8-bit green value scale, an 8-bit red value scale, and an 8-bit alpha scale. The parameters were changed to facilitate the x0, y0 values associated with the given equation, and the four color parameters were left unchanged. The method involved the use of the rewritten ellipse equation written into the parameters of the set_pixel() function. The absolute value function abs() provided by C++'s *cmath* library was used to accommodate the negative values produced in the equation and to create the second upper half of the elliptical arc. The offset value of 100 was incorporated into the equation in order to center the ellipse arc within the image dimensions.

3 Implementation

The main.cpp and BMP.h header were uploaded onto a new Replit project and run to show the initial display of a white horizontal line (y0 value: 100) in a black background. The rearranged ellipse equation was written into the for-loop statement within the set_pixel function's parameters. The integer value i in the for loop represented the value x0. Because the image dimensions were 200 x 200, the origin was set to the image's center, which in this case were the coordinates (100, 100). If the ellipse were translated with the given coordinates, the modified original equation would be as follows: ((x-100)/12) ^2 + ((y-100)/6) ^2 = 64^2. The rearranged equation would be as follows: y = y0 = (6 * sqrt (64^2 - ((x-100) ^2/144))) + 100. Due to the extensive use of parentheses in defining the second half of the equation, ((x-100)/12) ^2 was rewritten to (x-100) ^2/144 in order to avoid confusion with fraction part of the formula. In the initial stages of implementation, there were some issues regarding the full display of the elliptical arc; the image only displayed the upper right quarter of the arc. Upon further investigation, the solution presented itself as the implementation of the absolute value function, where the other quarter of the arc was created to display the full upper half of the elliptical arc. The for loop's x-value range (from x0 = 34 to x1 = 167) was also modified in order to display the necessary parts of the image.

4 Results

The output of the program was a downloadable .bmp file that was easy to display through an image viewer. The following image shows the upper half of an elliptical arc in a black background.