NITTE
EDUCATION TRUST

N.M.A.M. INSTITUTE OF TECHNOLOGY
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Department of Computer Science and Engineering

B.E.CSE Program Accredited by NBA,New Delhi from 1-7-2018 to 30-6-2021

Report on Mini Project

"Simulation of Scanline Polygon filling Algorithm"

Course Code: 18CS607

Course Name: Computer Graphics Lab

Semester: VI

Section :C

Submitted To:

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Date of submission:28-05-2021

Signature of Course Instructor

ABSTRACT

This project is aimed at developing an OpenGL application that represents the Global edge table and Active Edge table for scan-line algorithm used for filling a given polygon .

Our mini project covers all the necessary details starting from introduction about our mini project , the theory related to Global Edge table and Active Edge table by taking a static example . A menu interface is used to switch between different screen such as Introduction page , Home screen, Bucket Edge screen etc. We have explained the poygon filling algorithm by taking a triangle polygon . The Bucket Edge(Global Edge) and the Active Edge table is created with help of keyboard and mouse interactions. Finally with help of active edge table the scanlines of the given polygon is plotted .

INTRODUCTION

Computer Graphics is one of the most widely used powerful and interesting feature of computer programming which gives us the power to handle the graphical data very efficiently and also process them rapidly and effectively.The user controls the contents,structure and appearances of the object and of their displayed images by using input devices such as keyboard,mouse or touchscreen.Computer Graphics is used in animation and to simulate real world scenes

In this project ,a particular graphic software system called OpenGL is used .OpenGL is a cross-language, cross-platform application programming interface (API) for rendering 2D and 3D vector graphics. The application are designed to access OpenGL directly through functions from three libraries. The first is the GL library , the second is the OpenGL Utility library which uses only Glfunctions thus simplifying viewing .The third library is OpenGL Utility Toolkit.

With help of OpenGL , this project will demonstrate the working of scanline polygon filling algorithm using bucket edge table(Global edge table) and active edge table.

Scanline filling is basically filling up of polygons using horizontal lines or scanlines.

The purpose of the SLPF algorithm is to fill (color) the interior pixels of a polygon given only the vertices of the figure.This mini project will demonstrate by taking a simple polygon (triangle) .

Bucket Edge Table(Global Edge Table)

An initial table constructed and maintains information on edges intersecting the scan line based on the smallest y-coordinate values.

Active Edge Table

It maintains the information of the edges that are active for a particular scanline.Edges must be sorted in lower x coordinate values. This is simulated with the help of stack and linked list where the stack represents the y-coordinates and the linked list represent the edges that compose the figure.

Implementation Details(PsudoCode)

```
#include<bits/stdc++.h>
#include<GL/glut.h>      /* header files*/

int window;
int menu_id;
static int itemno=0;       /*global declarations*/

void *font =   GLUT_BITMAP_HELVETICA_18;  /*font style*/
  void *fonts[] =
  {
    GLUT_BITMAP_9_BY_15,
    GLUT_BITMAP_TIMES_ROMAN_10,
    GLUT_BITMAP_TIMES_ROMAN_24
};

void output(int x, int y, char *str)
{
  /*function to render text or characters on the screen where x and y are the coordinates
And str is the character to be displayed*/
   glRasterPos2f(x, y);
}
void display1()
{
/*coordinates to display the college name, project title,name,usn etc */
}
void introduction()
{
/* coordinates to display the introduction about the mini project */
}
void introduction2(){
/* introduction about the topic and some theoritical concepts */
}
Class button{
int x1,y1,x2,y2; //variables to get the coordinates to draw a button

public:
button(int x11,int y11,int x22,int y22,char *str1)
{   /* takes the coordiantes  of button */
}
/* function declaration*/
};
```

```
Class stack{

  button s[size];
     int top;
public:
     stack()
     {
             top=-1;
     }
     int stfull();
     void push(int item);
     int stempty();
     void displaystack();
  };
stack st,st1;
};
  class linkedList         //linked list class for displaying intersecting edges

  {

  button que[MAX];

  int front;
public:
  linkedList()
  {
          front=-1;
  }

  void displaylinkedList();
  void insert_element(int ch);
  };

  linkedList q;
  void button::draw()

  {

  /*  draws a button based on coordinate values  */

  }

  void button::togglestate(void){
```

```
 /* state of the button*/

 }

 int stack::stfull(){} // check if stack is full

 void stack::push(int item) //push an item to stack
 void stack::displaystack(){} //display the values
 void linkedList::insert_element(int ch) {}
 void linkedList::displaylinkedList(){}
 void show(void)  //display bucket edge values
 void show1(void) //display bucket edge values
 void display()//display bucket edge table screen
 void mouse(int btn, int state, int x, int y)    //mouse interaction \
 void display3(){} //display a polygon for which we find the active edges
 void scanfill(float x1,float y1,float x2,float y2,float x3,float y3,float x4,float y4)
 /     * scanfill() is used to fill the polygon */

void activeybox1() //display y coordinate button for active edge y=1
void activeybox2() //display y coordinate button for active edge y=2
void activeybox3() //display y coordinate button for active edge y=3
void activeybox4() //display y coordinate button for active edge y=4
void activeybox5() //display y coordinate button for active edge y=5
void activeybox6() //display y coordinate button for active edge y=6

/*  function to display active edges  for corressponding y values for active edges*/
 void activebox1()
 void activebox2()
 void activebox3()
 void activebox4()
 void activebox5()
 void activebox6()
 void activebox7()
 void activebox8()
void activebox9()
 void activebox10()
 void activebox11()
 void activebox12()
```

```
/* end of activebox() functions*/
void scanline(){}  // plot the scanline for the given polygon
void keyboard(unsigned char key,int x,int y) //keyboard interrupt
void fillMenu(int option)
{
/* switch between the screens */
 }
 void createMenu(void) {

 /* create menu with different options */

}

  int main(int argc, char* argv[])
  {
  glutInit(&argc,argv);
  glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
  glutInitWindowSize(600,600);
  glutInitWindowPosition(500,100);
  glutCreateWindow("Scan-line polygon filling Algorithm");
  init();
  glutDisplayFunc(display1);
  glutKeyboardFunc(keyboard);
  glutMouseFunc(mouse);
  glutIdleFunc(idle);
  createMenu();
  glutMainLoop();
}
```

Conclusion

The primary goal of this project is to illustrate concepts learnt in the theorey and to give better knowledge of these concepts.By visually representing the concept of active edge table and bucket edge(global edge table) the viewers get a clear idea of it.The function available in Opengl are henceforth demonstrated.The keyboard and mouse driven interfaces are used to show various features of the project and to change the appearance of the object.This reduces the complexity and improves the case with which any kind of user can run it.The mini project has also helped in understanding the working of computer graphics using opengl and the various concepts ,functions and methodologies required for the development of a graphics package

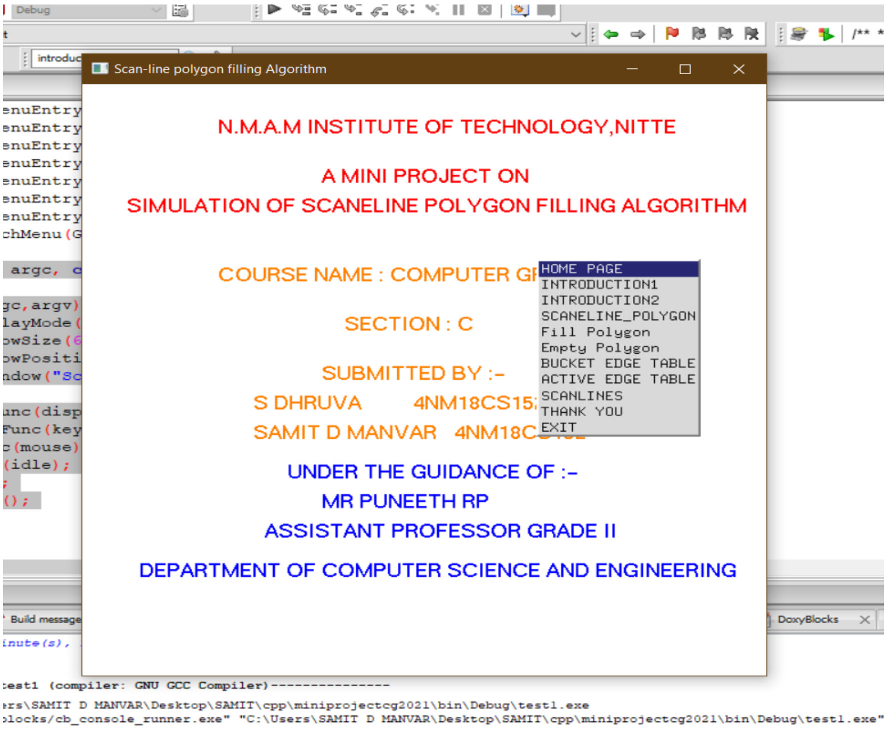
REFERENCES

[1] https://www.opengl.org

[2] https://learnopengl.com/

Appendix

Screenshots of the project



N.M.A.M INSTITUTE OF TECHNOLOGY,NITTE

A MINI PROJECT ON
SIMULATION OF SCANELINE POLYGON FILLING ALGORITHM

COURSE NAME : COMPUTER GR

SECTION : C

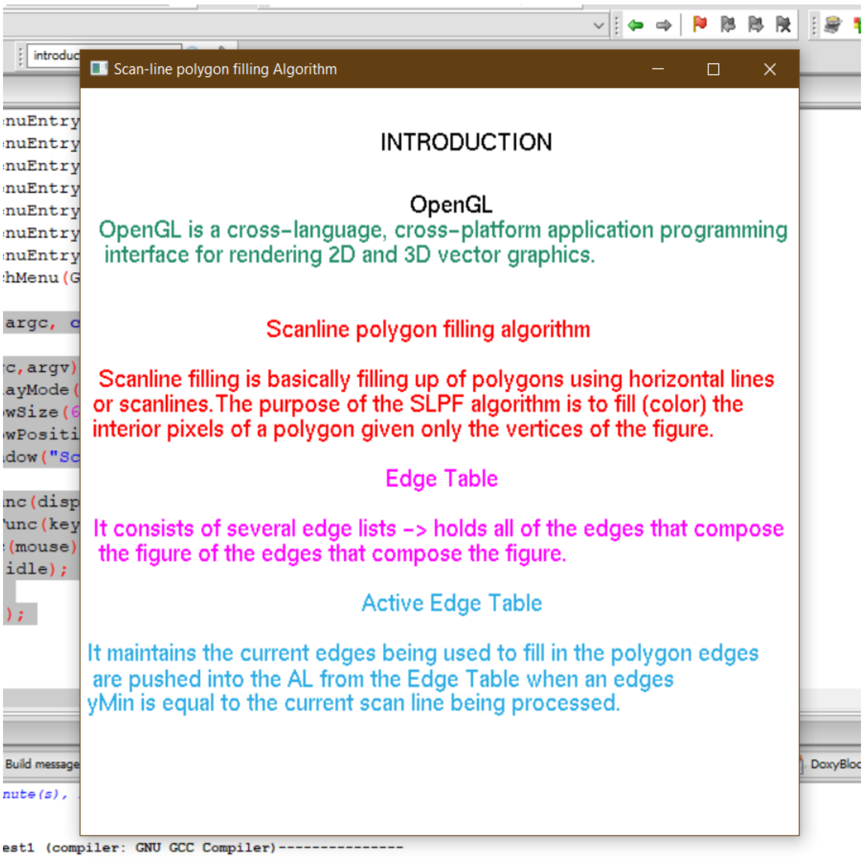
SUBMITTED BY :-
S DHRUVA 4NM18CS15
SAMIT D MANVAR 4NM18C

UNDER THE GUIDANCE OF :-
MR PUNEETH RP
ASSISTANT PROFESSOR GRADE II

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

```
test1 (compiler: GNU GCC Compiler)---------------
ers\SAMIT D MANVAR\Desktop\SAMIT\cpp\miniprojectcg2021\bin\Debug\test1.exe
blocks/cb_console_runner.exe" "C:\Users\SAMIT D MANVAR\Desktop\SAMIT\cpp\miniprojectcg2021\bin\Debug\test1.exe"
```

Home page with menu



INTRODUCTION

OpenGL
OpenGL is a cross-language, cross-platform application programming interface for rendering 2D and 3D vector graphics.

Scanline polygon filling algorithm

Scanline filling is basically filling up of polygons using horizontal lines or scanlines.The purpose of the SLPF algorithm is to fill (color) the interior pixels of a polygon given only the vertices of the figure.

Edge Table

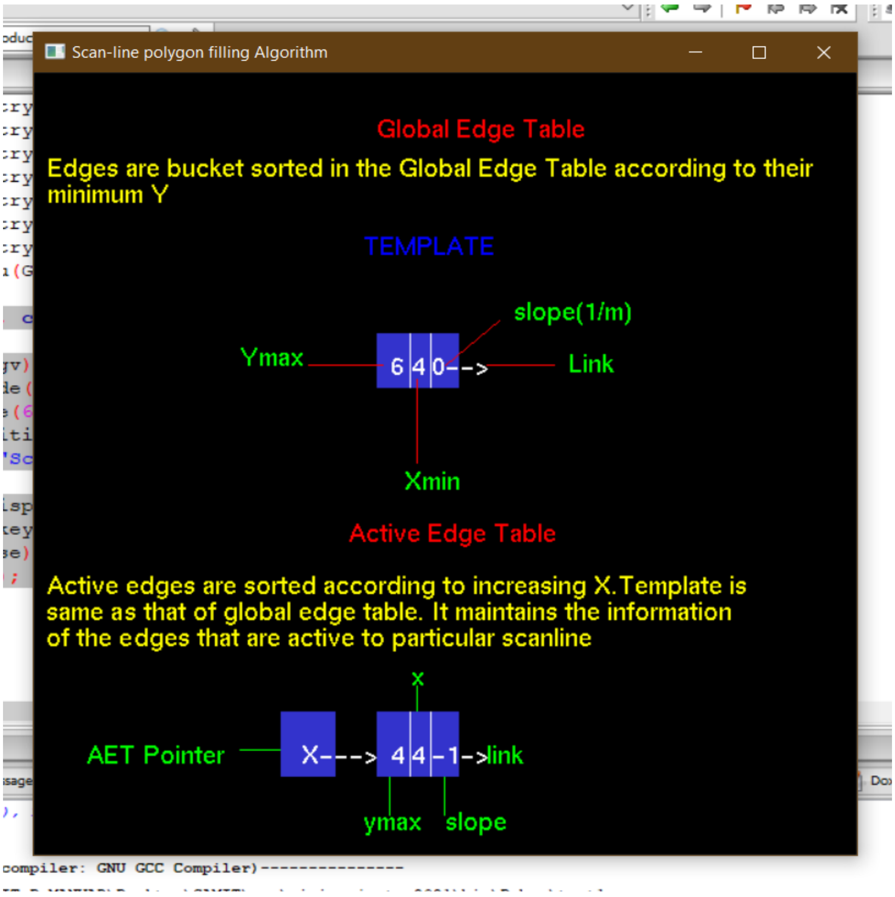
It consists of several edge lists -> holds all of the edges that compose the figure of the edges that compose the figure.

Active Edge Table

It maintains the current edges being used to fill in the polygon edges are pushed into the AL from the Edge Table when an edges yMin is equal to the current scan line being processed.

```
est1 (compiler: GNU GCC Compiler)---------------
```

Introduction page(1)



Scan-line polygon filling Algorithm

Global Edge Table

Edges are bucket sorted in the Global Edge Table according to their minimum Y

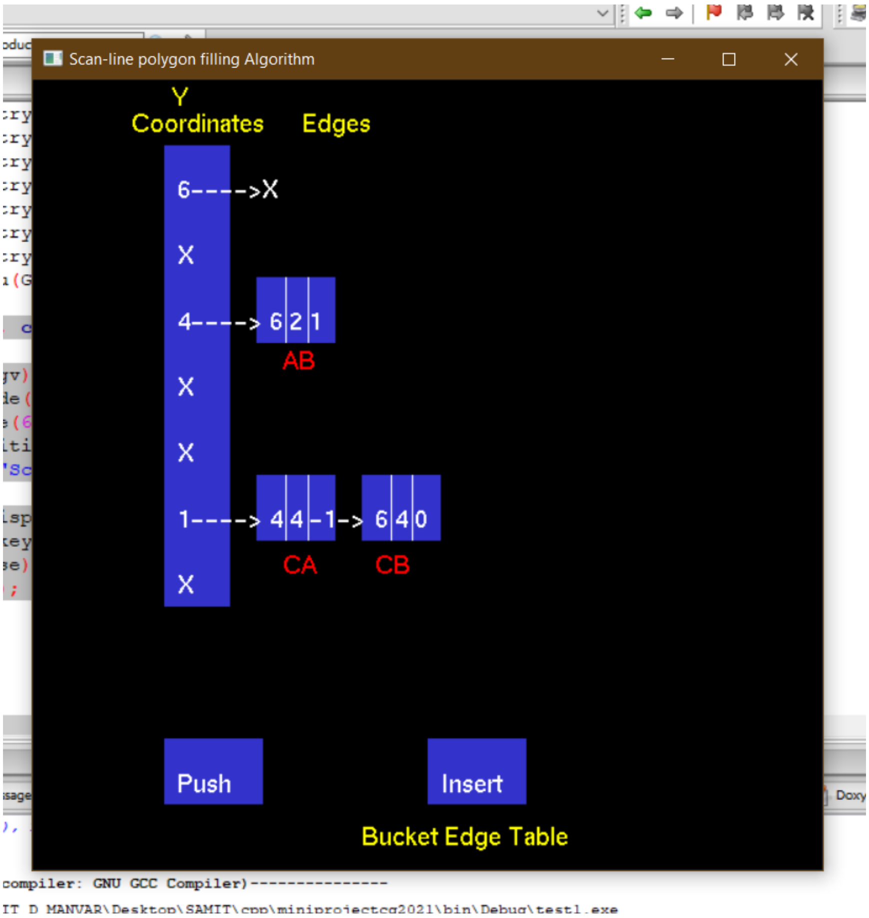
TEMPLATE

Active Edge Table

Active edges are sorted according to increasing X.Template is same as that of global edge table. It maintains the information of the edges that are active to particular scanline

```
compiler: GNU GCC Compiler)---------------
```

Introduction page(2)

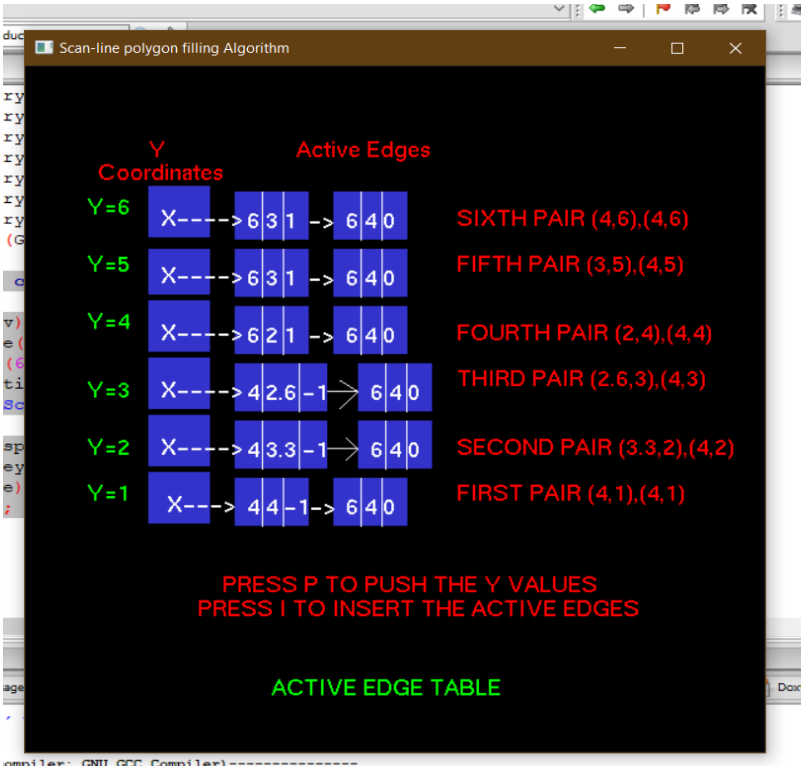


Scan-line polygon filling Algorithm

Bucket Edge Table

```
compiler: GNU GCC Compiler)---------------
IT D MANVAR\Desktop\SAMIT\cpp\miniprojectcg2021\bin\Debug\test1.exe
```

Bucket Edge Table



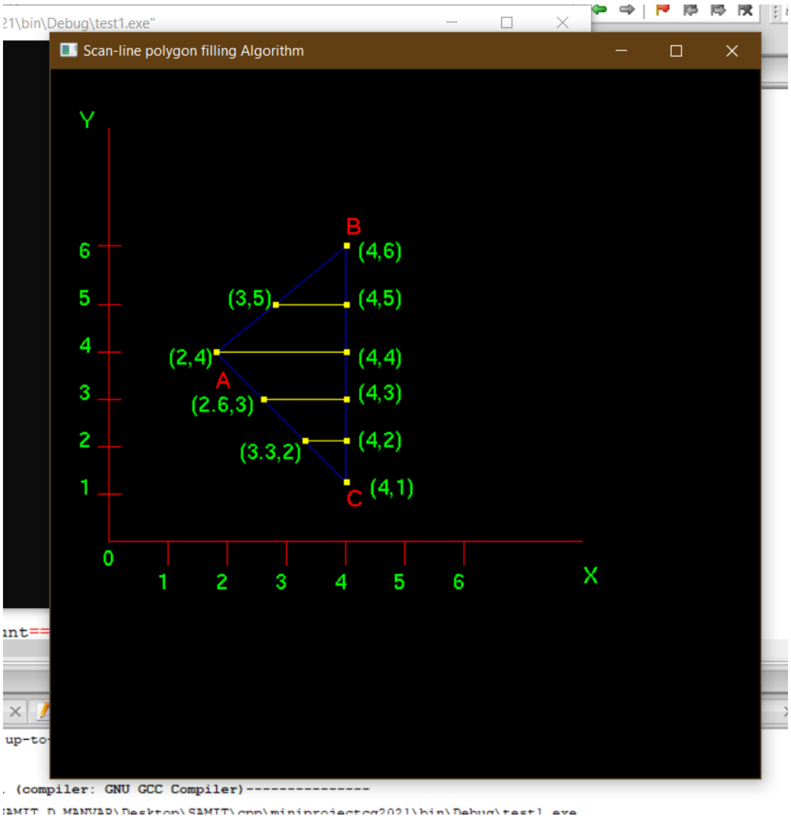
Scan-line polygon filling Algorithm

Y Coordinates	Active Edges	
Y=6	X---->6 3 1 -> 6 4 0	SIXTH PAIR (4,6),(4,6)
Y=5	X---->6 3 1 -> 6 4 0	FIFTH PAIR (3,5),(4,5)
Y=4	X---->6 2 1 -> 6 4 0	FOURTH PAIR (2,4),(4,4)
Y=3	X---->4 2.6 -1 -> 6 4 0	THIRD PAIR (2.6,3),(4,3)
Y=2	X---->4 3.3 -1 -> 6 4 0	SECOND PAIR (3.3,2),(4,2)
Y=1	X---> 4 4 -1-> 6 4 0	FIRST PAIR (4,1),(4,1)

PRESS P TO PUSH THE Y VALUES
PRESS I TO INSERT THE ACTIVE EDGES

ACTIVE EDGE TABLE

Active Edge Table



Scanlines for the given polygon