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Computer Graphics Lab [CSL 358]

A Project submitted on

Volcanic Eruption Simulation

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Volcanic Eruption Simulation Using C Graphics

Title:-

Volcanic Eruption Simulation Using C Graphics

Abstract:-

This project aims to simulate a volcanic eruption using the graphical capabilities of the C programming language. The objectives are to visually represent a volcanic eruption, demonstrating the lava flow and ash cloud dispersion, while exploring the graphical functions available in C. The project highlights the methods and techniques used to create this simulation, including the initialization of graphics, drawing the volcano, animating the lava flow, and illustrating the smoke and ash clouds. The key findings show that it is possible to create an effective visual representation of a volcanic eruption using C's graphics library.

Introduction: -

Background Information

Volcanic eruptions are natural events characterized by the expulsion of lava, ash, and gases from a volcano. These eruptions can be highly destructive but are also of significant geological and scientific interest. Understanding the dynamics of volcanic eruptions can provide valuable insights into earth sciences and natural disaster preparedness.

Problem Statement

Creating an accurate and engaging visual simulation of a volcanic eruption can be challenging due to the complexity of the phenomena involved. The goal is to develop a simulation that is both educational and visually appealing using basic graphical functions in C.

Motivation and Significance

The motivation behind this project is to utilize the graphical capabilities of the C programming language to create an educational tool. This simulation can help in understanding the sequence of events during a volcanic eruption and demonstrate the use of computer graphics for scientific visualization.

Objectives and Goals

- To develop a graphical simulation of a volcanic eruption.
- To animate the lava flow and the dispersion of ash clouds.
- To explore and utilize the graphical functions in C for creating animations.

Methodology

Approach

The project employs the Turbo C++ graphics library to create and animate the volcanic eruption. The approach includes:

1. Initializing the graphics mode.
2. Drawing the static components of the volcano.
3. Animating the dynamic elements like lava flow and ash clouds.

Tools and Technologies

- **Turbo C++ IDE**: Used for writing and compiling the C code.
- **Graphics Library**: Part of the Turbo C++ environment, used for drawing and animations.
- **DOSBox**: An emulator to run Turbo C++ on modern operating systems.

Techniques Employed

- **Graphics Initialization**: Setting up the graphics mode using `initgraph()`.

- **Polygon Drawing**: Using `drawpoly()` to create the volcano structure.

- **Flood Fill**: Applying colors using `floodfill()`.

- **Line Drawing**: Animating lava flow with `line()` and `delay()`.

- **Ellipse and Pie Slices**: Creating smoke and ash clouds with `ellipse()` and `pieslice()`.

Implementation

Step-by-Step Development

1. **Initialization**: The graphics mode is initialized using the `initgraph()` function.

2. **Drawing the Volcano**: The volcano's base and structure are drawn using `drawpoly()`, and filled with color using `floodfill()`.

3. **Animating Lava Flow**: A loop is used to animate the rising lava by incrementally drawing lines from the crater.

4. **Smoke and Ash Clouds**: Ellipses and pie slices are used to depict the smoke and ash clouds emanating from the volcano.

Code Snippet

```
#include<graphics.h>

#include<conio.h>

#include<math.h>

#include<stdlib.h>


int main()

{
```

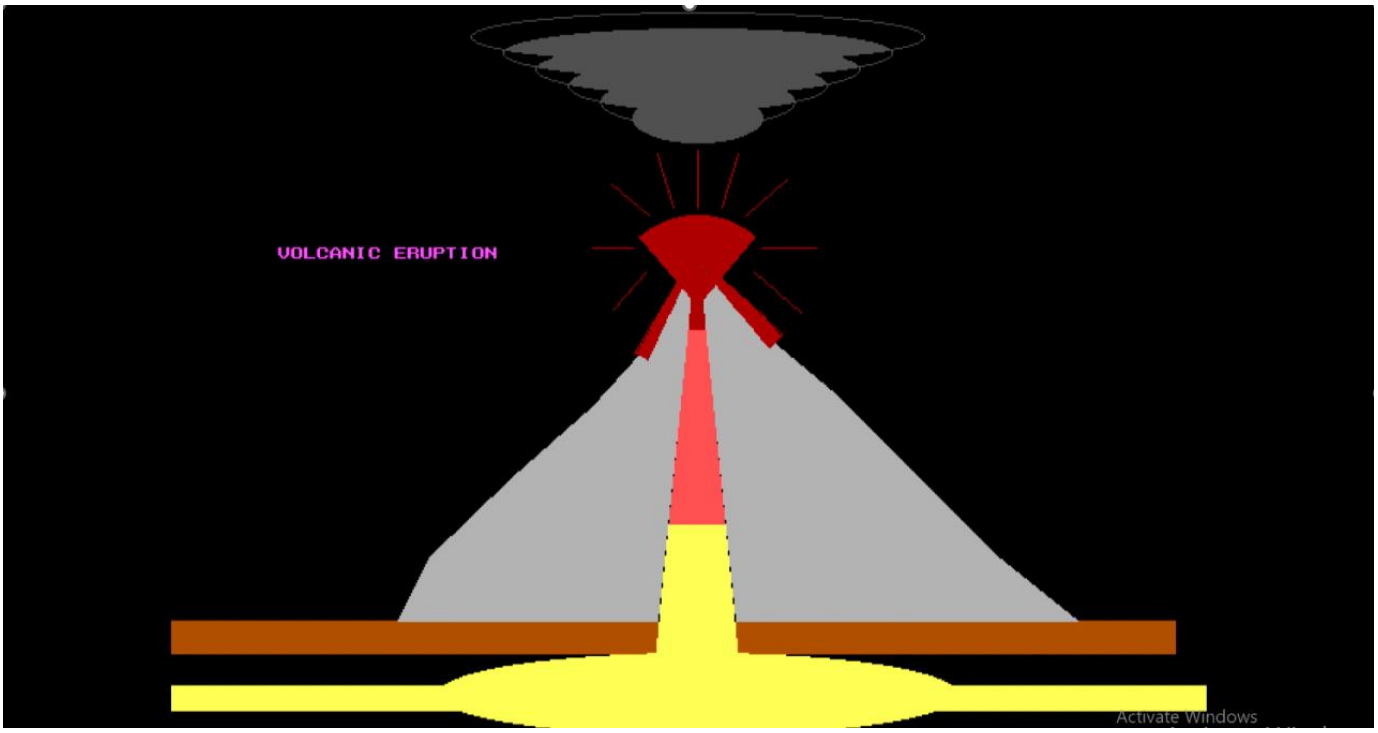
```
  int gd=DETECT, gm;
  float i=0, j=0;
  int k=0, l=0;
  int trpz[] = {349,380,325,150,324,150,300,380};
  int trpzl[] = {140,380,300,380,323,160,300,204,260,248,210,292,160,340,150,360,140


380};
  int trpzr[] = {349,380,560,380,510,340,460,290,410,240,350,190,326,160,349,380};


  initgraph(&gd, &gm, "C:\\Turboc3\\bgi");


  setcolor(13);
  outtextxy(50,150, "  VOLCANIC ERUPTION  ");
  setcolor(6);
  rectangle(0,380,300,400);
  setfillstyle(1,6);
  floodfill(1,381,6);
  rectangle(349,380,620,400);
  setfillstyle(1,6);
  floodfill(350,381,6);
  drawpoly(4, trpz);
  drawpoly(9, trpzl);
  setfillstyle(1,6);
  floodfill(141,379,6);
  drawpoly(8, trpzr);
  setfillstyle(1,6);
```

```
floodfill(350,379,6);

for(k=0; k<300; k++)
{
   setcolor(14);
   line(0+k,420,0+k,435);
   line(640-k,420,640-k,435);
   delay(10);
}

setcolor(14);
ellipse(325,425,0,360,160,25);
setfillstyle(1,14);
floodfill(326,426,14);

for(; i<27 && j<400;)
{
   if(j<80)
      setcolor(14);
   else if(j>=80 && j<200)
      setcolor(LIGHTRED);
   else if(j>255 && j<400)
   {
      setcolor(4);
      pieslice(325,185,50,130,55);
      setfillstyle(1,4);
```

```
      floodfill(326,151,4);
   }
   else
      setcolor(RED);

   line(300+i,400-j,350-i,400-j);
   delay(20);
   i = i + 0.1;
   j = j + 1;
}

setcolor(4);
line(325,125,325,90);
line(340,125,350,92);
line(355,130,380,108);
line(365,150,398,150);
line(360,165,389,190);
line(310,125,300,92);
line(295,130,272,111);
line(285,150,260,150);
line(293,165,273,188);

for(l=0; l<=5; l++)
{
   setcolor(7);
   ellipse(325,70-(10*l),0,360,40+(20*l),15);
```

```
    setfillstyle(1,7);
    floodfill(326,71-(10*l),7);
    delay(40);
  }

  for(l=1; l<=5; l++)
  {
    setcolor(4);
    pieslice(325,150,244-l,246,15*l);
    pieslice(325,157,310,324-l,14*l);
    setfillstyle(1,4);
    floodfill(320,159,4);
    delay(200);
  }

  getch();
  closegraph();
  return 0;
}
```

Output:-



Results and Analysis

Results

The simulation successfully depicts the various stages of a volcanic eruption, including:

- The formation of the volcano.

- The animation of the lava flow.

- The dispersion of smoke and ash clouds.

Analysis

The graphical representation is effective in demonstrating the

eruption sequence. The use of simple graphical functions in C, such as line drawing, filling polygons, and drawing ellipses, proves to be sufficient for creating a visually informative simulation. The delays inserted in the animation loops help in creating a smooth and continuous visual effect, enhancing the realism of the simulation.

Visual Aids

Although this report cannot include dynamic visual aids, the description of the implementation and the code provided should offer sufficient detail for understanding the simulation's visual output.

Conclusion

Key Findings

- The project demonstrates that C's graphics library can be effectively used to simulate natural phenomena like volcanic eruptions.

- The animation successfully visualizes the process of a volcanic eruption, from lava flow to ash dispersion.

Evaluation of Objectives

The project met its objectives by creating an educational and visually appealing simulation of a volcanic eruption. The use of basic graphical functions in C was sufficient to achieve the desired visual effects.

References

- Turbo C++ Documentation: Graphics Library

- DOSBox Emulator for Turbo C++ Environment

- C Programming Language Resources and Tutorials
