Simulation of Cathode Ray Tube

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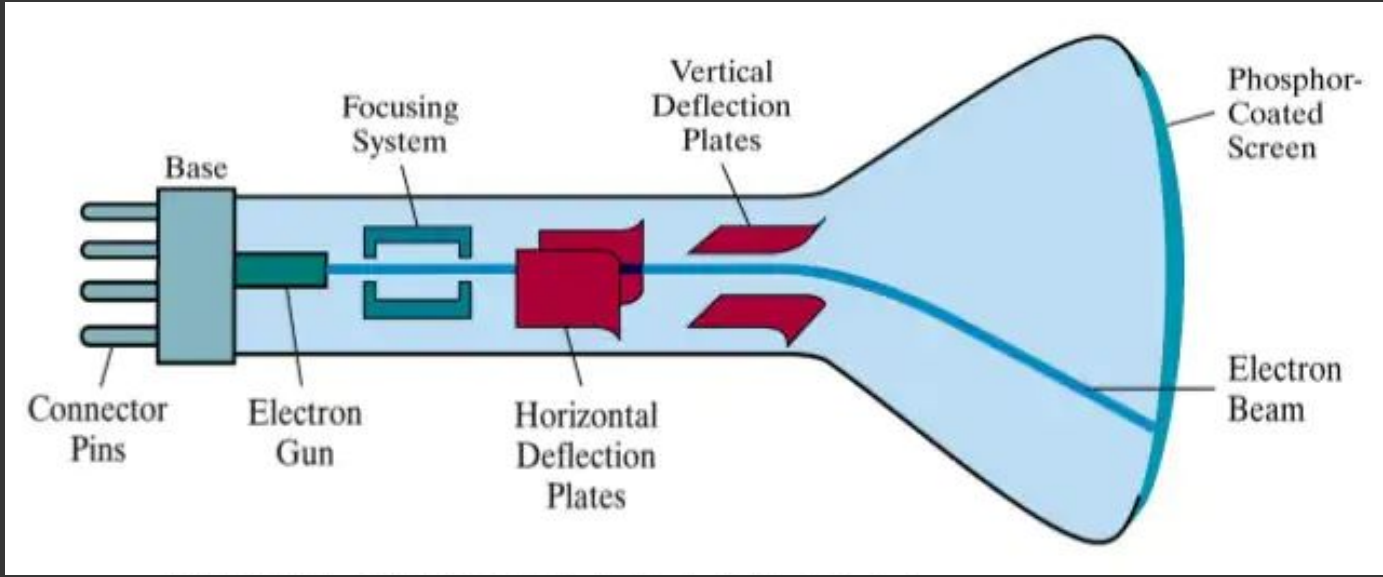
Introduction

What is Cathode Ray Tube

The Cathode ray tube (CRT) is a vacuum tube containing an electron gun (a source of electrons) and a fluorescent screen, with internal or external means to accelerate and deflect the electron beam, used to create images in the form of light emitted from the fluorescent screen.

Basic Cathode Ray Tube



02

Working & Applications

Working

A CRT monitor contains millions of tiny red, green and blue phosphor dots that glow when struck by an electron beam that travels across the screen to create a visible image. In a CRT monitor, the cathode is a heated filament. The heated filament created a vacuum inside a glass tube. The electrons are negative and the screen gives a positive charge so the screen glows when the screen struck by electrons

The Working of CRT can be Split in 3 main sections :

1) Electron Gun
2) Deflection System
3) Fluorescent Screen

Electron Gun

- The role of this section is to produce electrons at a high, fixed velocity
- This is done through a process known as thermionic emission

Deflection System

- It contains two perpendicular sets of Electric / Magnetic fields
- This allows control over both horizontal and vertical axes
- By controlling the Voltage applied to the fields, it is possible to vary the deflection through Electrostatic and Magnetic force

Fluorescent Screen

- The role of this part is to display where the electrons are the hitting
- It is a screen coated with a material that emits light when struck by electrons
- Zinc sulfide or Phosphorous are two commonly used materials

Applications

- In Televisions
- In Computer monitors
- As a Display devices in radars
- In cathode ray oscilloscope

03

Project Breakdown

Breakdown

The Project can be broken into the following steps

1) Drawing the outer body and parts of the CRT
2) Tracing the ray based on the input coordinates of the point

Step-1

In this step of the project, we will plot the outline of the cathode ray tube and its inner parts.
Outline and inner parts are drawn with help of OpenGL Functions and algorithms taught in class

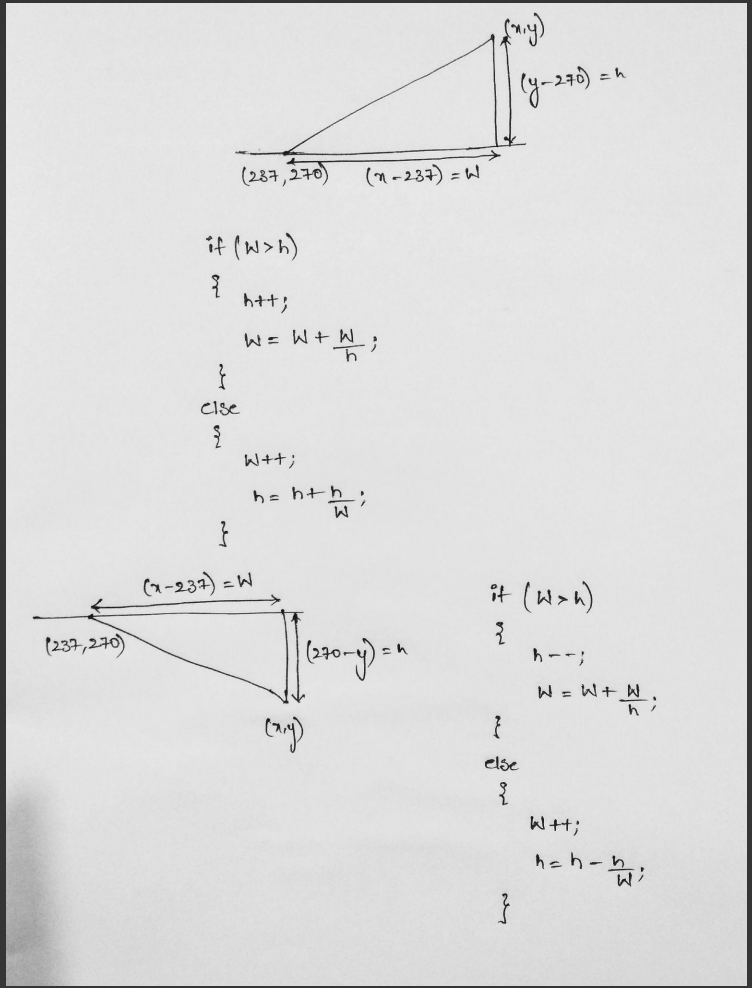
Here we are using the timer function to call the function after some time recursively
Say if we call some function for every 1/60th of a second basically, it is nothing but displaying the animation at 60 frames per second

Step - 2

In this step, we will be asking for coordinates of the point to be lit on the CRT screen.
After getting the point we have to plot the electron beam from the filament of the electron gun to the end of the deflecting plates to the fluorescent screens and then from the end of the deflecting plates to the point itself.

Plotting the electrons from the filament of the electron gun to the deflecting plates is simple as they move in the x-direction, which makes it easy to plot

But plotting the electron beam from the end of the deflecting plates to the fluorescent screen is not as simple as earlier as the point does remain constant and is explained in the next slide



C(237,270) is the end point of deflection plates and say (x,y) is the point where the pixel has to be lit. if the point the above the horizontal line passing through c then we increment min(w,h) by 1 unit every time and increment the other by splitting its length into min(w,h) parts and incrementing one part every time

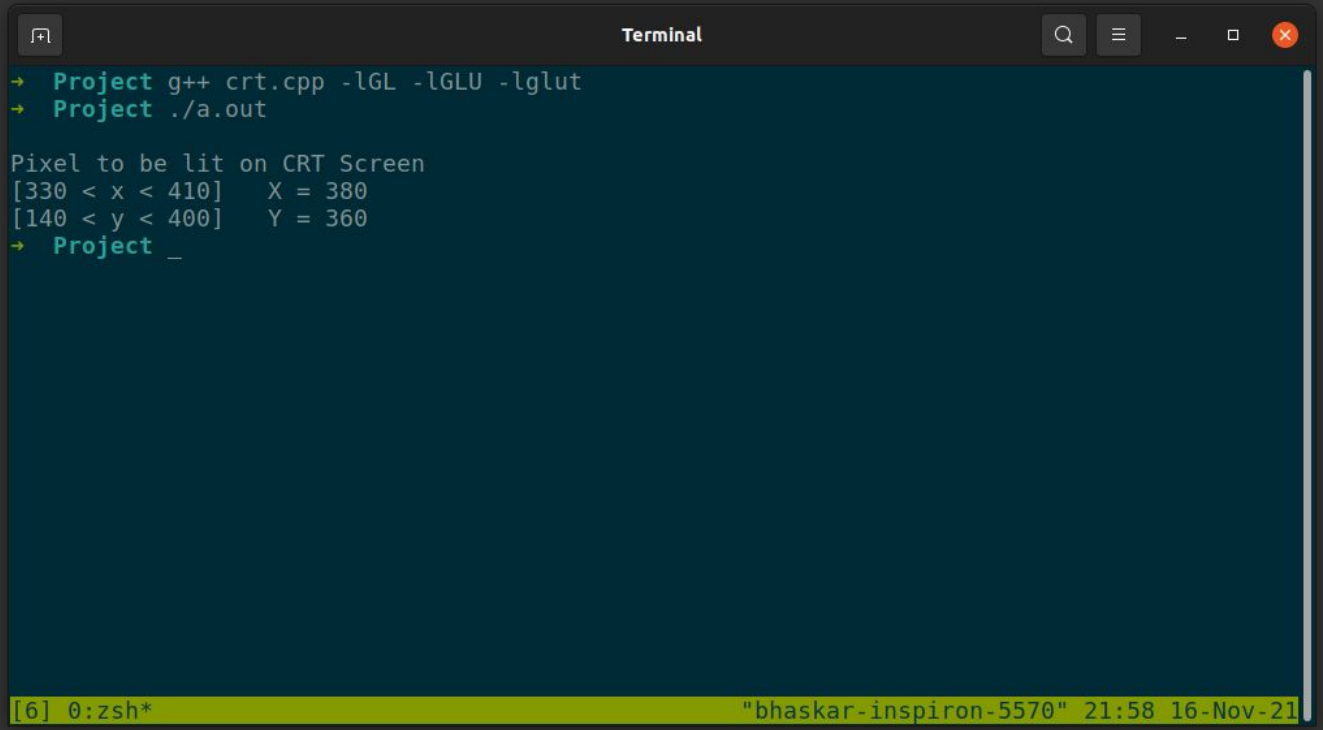
When the point is below the horizontal line the only difference would be that we will be decrementing every by 1 unit and the process remains the same.

04

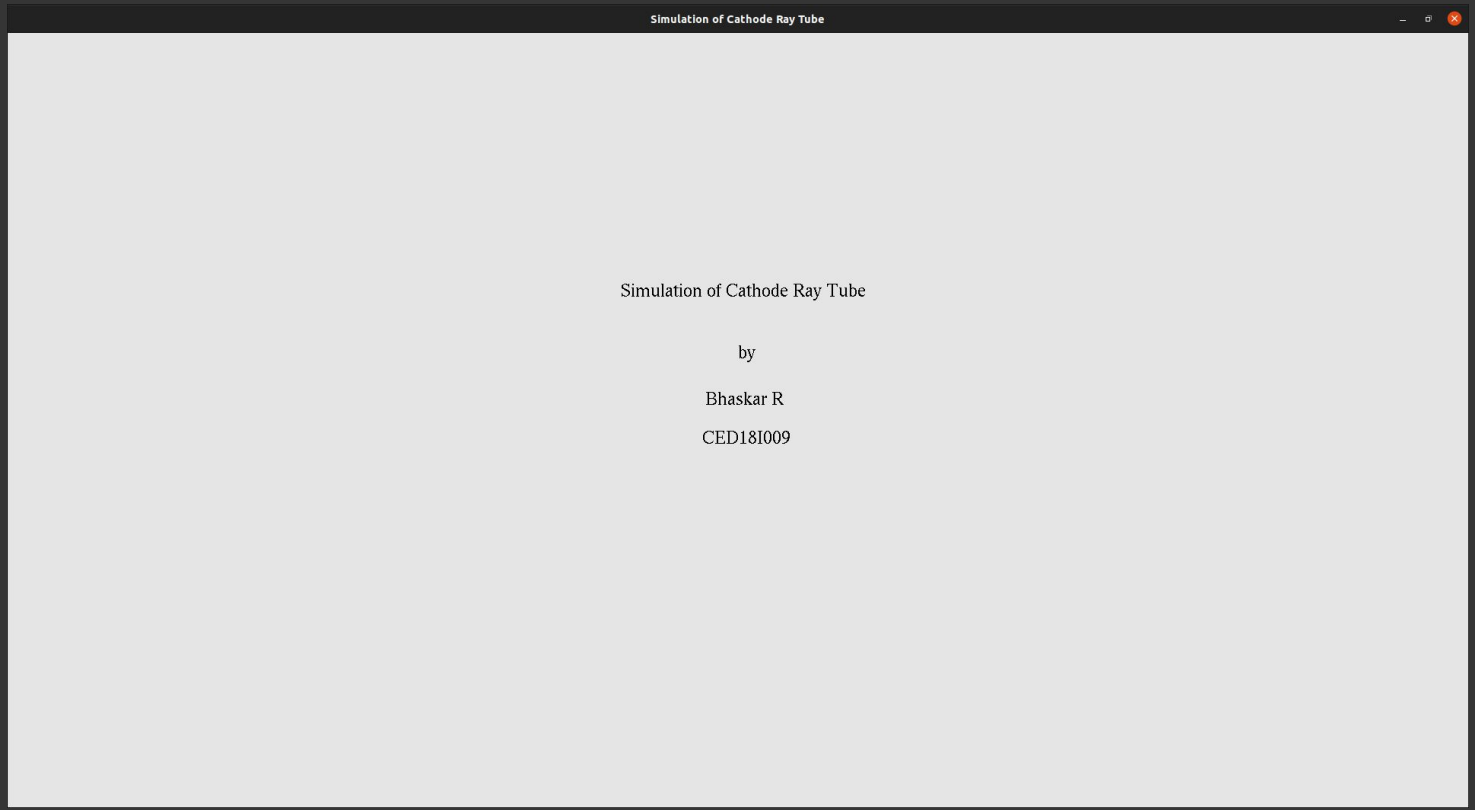
Code Execution

Output

- On Running we are asked to enter the pixel to be lit and on entering, a new display window pops up with the output animation



Output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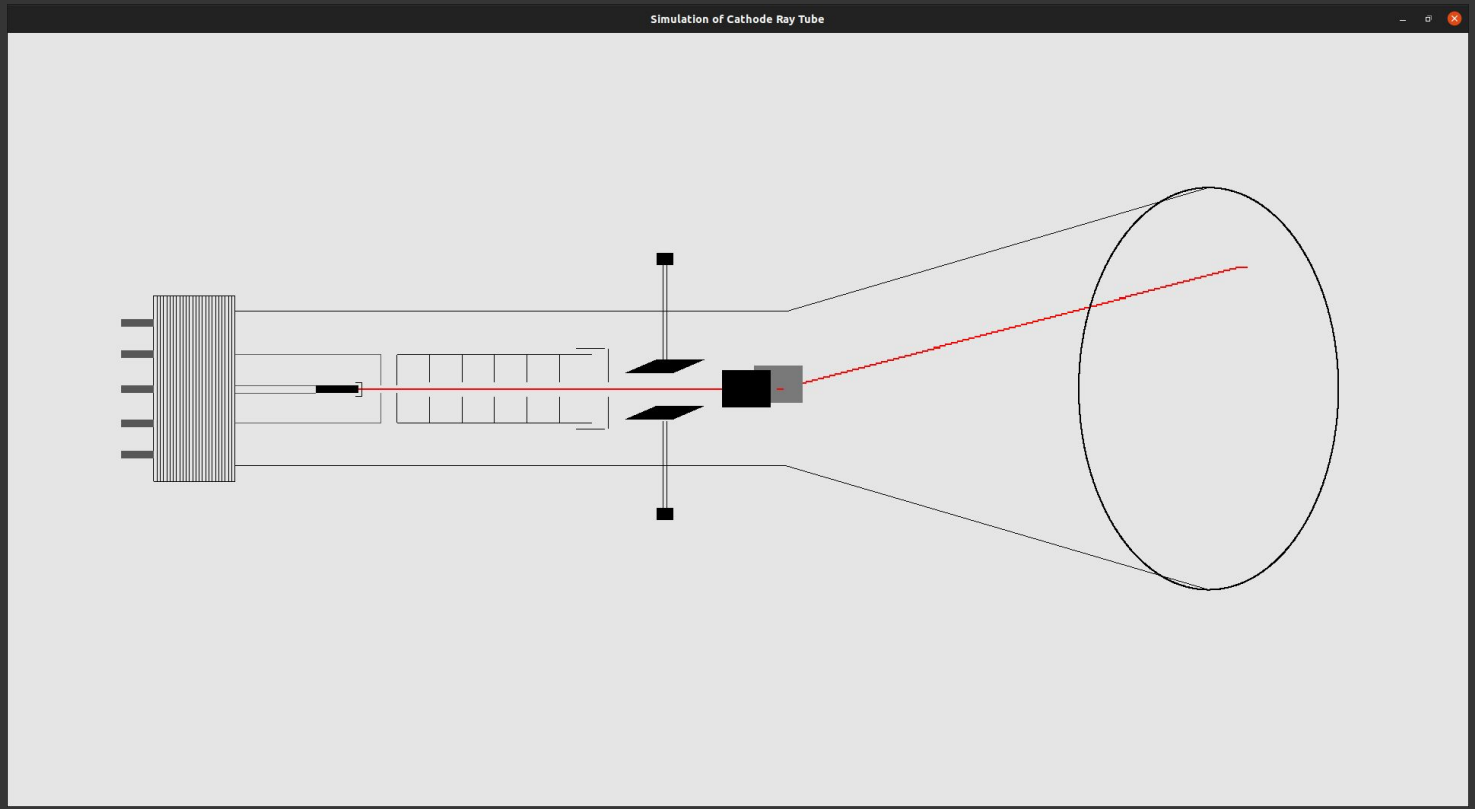
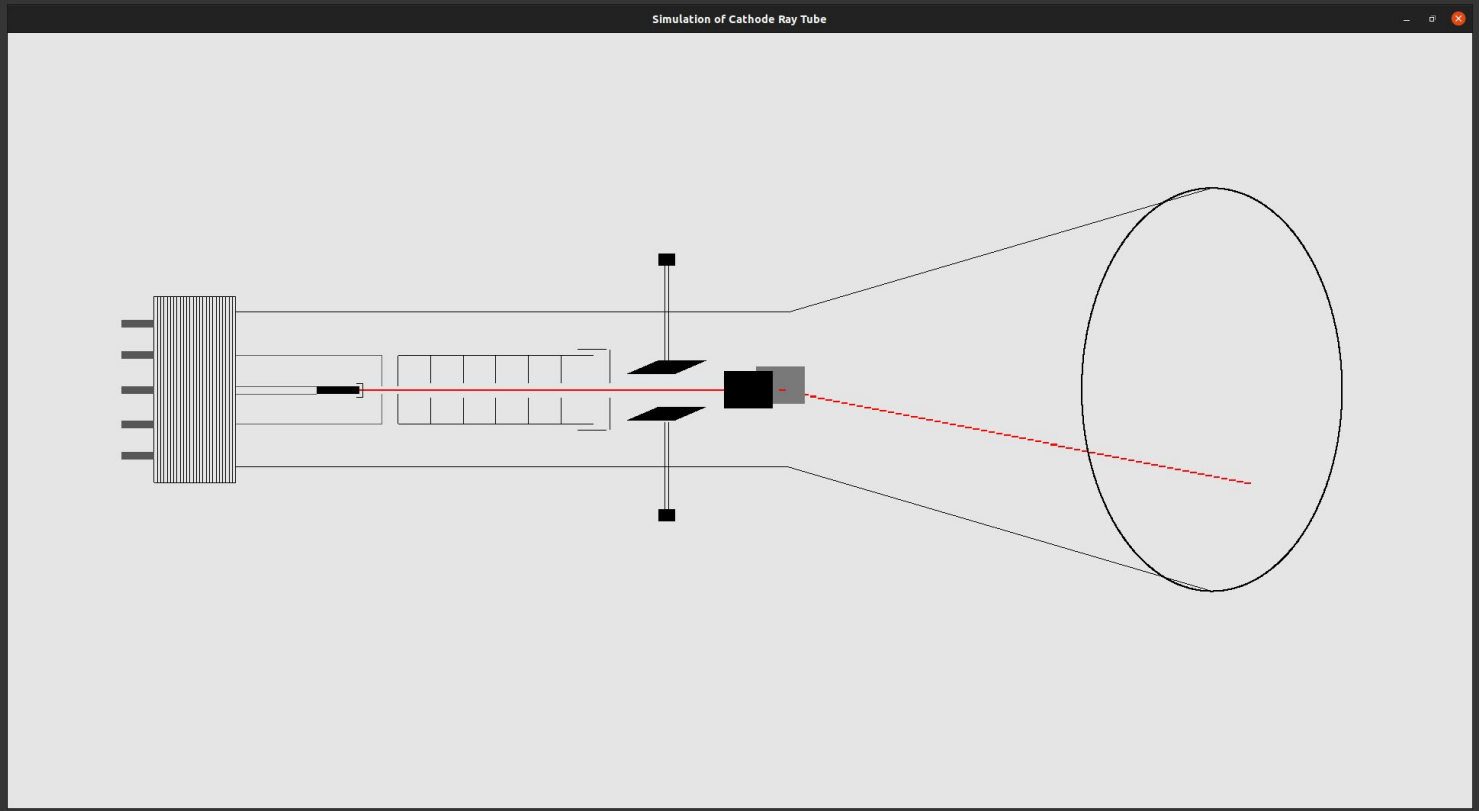
Output



Output



Thanks!