الجامعة المستنصرية

كلية العلوم

قسم:الحاسبات

عنوان التقرير

Normalized Device Coordinates

أسم الطالب الرباعي: علي لؤي خلف جلوب

التـــــوقيع:

القسم: علوم الحاسبات **المـــرحلة: الثالثة**

الشعبـــة : A1 **الفـــــرع: CS**

البريد الالكتروني: luaya577@gmail.com

التقرير مقدم من ضمن متطلبات درجة الامتحان النهائي

لمادة رسم بالحاسب

يملئ من قبل أستاذ المادة					
اسم الأستاذ:					
الدرجة					
من					

ختم اللجنة الامتحانية

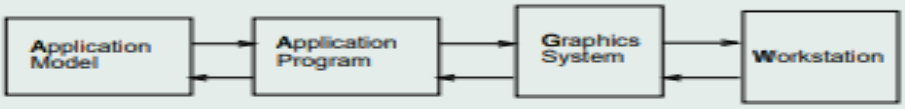
توقيع المدقق

Introduction:

Normalized device coordinates (NDCs) We need to use a device independent coordinate system called (NCD) to describe the viewport. This device (NCD) better than using the coordinate of the display screen to describe the viewport. The (NCD) system allows the application programmer to write graphics programs independent of the resolution of the display screen.

Normalized device coordinates:-also commonly known as "screen space" although that term is a little loose, are what you get after applying the perspective divide to clip space coordinates. The 3D coordinates now represent the 2D positions of points on screen, with X and Y in [−1, 1], together with the depth within the depth buffer range, Z in [0, 1] for D3D or [−1, 1] for OpenGL. The axis orientation is X = right, Y = up, and Z can be either forward or backward depending on the depth buffer configuration.

Normalized Device Coordinate System (NDC)



- The standardized coordinate system for all devices.
- Ranges from $(0.0 - 1.0)$ in each dimension.
- Convenient for all device drivers.
- A convenient space for performain *Pick* operations.

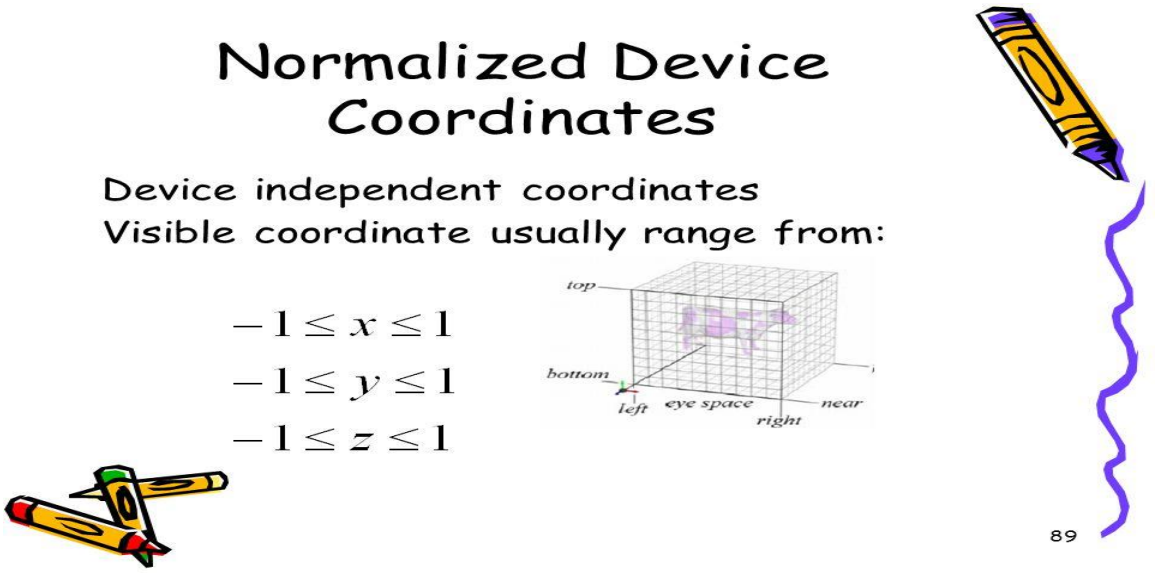
Normalized device coordinates system

Device-independent two-dimensional or three-dimensional Cartesian coordinate system whose coordinates are in the range 0 to 1. Normalized device coordinates are used in defining views of objects. In particular, they are used for specifying viewports, image transformation, and input from stroke and locator devices.

NDC Space and the Viewport Transform

Normalized device coordinate or NDC space is a screen independent display coordinate system; it encompasses a cube where the x, y, and z components range from −1 to 1. Although clipping to the view volume is specified to happen in clip space, NDC space can be thought of as the space that defines the view volume. The view volume is effectively the result of reversing the divide by wclip operation on the corners of the NDC cube.

The current **viewport transform** is applied to each vertex coordinate to generate window space coordinates. The viewport transform scales and biases xndc and yndc components to fit within the currently defined viewport, while the zndc component is scaled and biased to the currently defined depth range. By convention, this transformed z value is referred to as depth rather than z. The viewport is defined by integral origin, width, and height values measured in pixels.



Normalized device coordinates in computer graphics

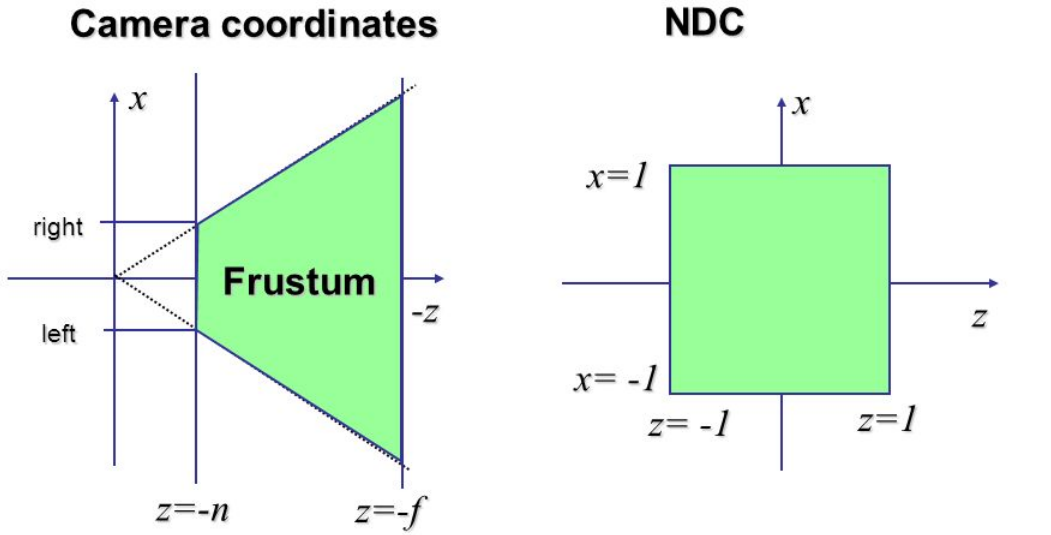
Normalized device coordinates (NDCs) make up a coordinate system that describes positions on a virtual plotting device. The lower left corner corresponds to (0,0), and the upper right corner corresponds to (1,1).

NDCs can be used when you want to position text, lines, markers, or polygons anywhere on the plotting device (that may or may not already contain a plot).

To help figure out what NDC coordinates to use for positioning text and primitives, you can use the handy drawNDCGrid procedure, which draws an NDC grid labeled with coordinate positions.

Normalized Device Coordinates

left/right x =+/- 1, top/bottom y =+/- 1, near/far z =+/- 1



55

Normalized Device Coordinates

This is a device-independent coordinate system used by GKS as an addressing system for a virtual plotting device; it is a two dimensional Cartesian space that has horizontal and vertical ranges of 0. to 1. inclusive. In GKS, a transformation is performed from a subrectangle of world coordinates (called a "window") to a subrectangle of the normalized device coordinates (NDC). The rectangular subspace of NDC is called a "viewport.". To ensure that squares in world coordinates are mapped onto squares on the output plotting device, the maximum display surface on that

device will be the largest square which will fit on the plotting device. The NCAR Graphics CGM interpreter, ctrans, centers the maximum viewport on an output plotting device. X11 output is centered in the output window. PostScript output is centered on the page by default, but options exist for positioning PostScript output anywhere on the page.

Plotting in Normal and Device Coordinates

The plots procedure plots lines or points in data coordinates by default, but also offers the option of plotting in normal or device coordinates. The general syntax for plots is `plots, x, y`

where x and y are vectors of ordinate and coordinate data, respectively. If a single vector argument is passed, the data points are plotted against the corresponding element number in the input vector. The default is to plot a line joining the data points in data coordinates. However, if the optional /normal keyword is set, the supplied data points are plotted in normal coordinates, and if the optional /device keyword is set, the supplied data points are plotted in device coordinates.

In the following example, lines are plotted between opposite corners of the current window:

```
IDL> window, /free
IDL> plots, [0.0, 1.0], [0.0, 1.0], /normal
IDL> plots, [0.0, 1.0], [1.0, 0.0], /normal
```

References

- https://computergraphics.stackexchange.com/questions/1769/world-coordinates-normalised-device-coordinates-and-device-coordinates
- https://www.sciencedirect.com/topics/computer-science/device-coordinate
- https://www.ncl.ucar.edu/Document/Graphics/ndc.shtml#:~:text=Normalized%20device%20coordinates%20(NDCs)%20make,to%20(1%2C1).
- http://ngwww.ucar.edu/gks/coords.html
- http://printwiki.org/Normalized_Device_Coordinate_System