Game Notes

Aresh Pourkavoos

April 29, 2022

Position within square stored as an odd signed integer in half-pixels, e.g.

101	011	001	011
-3	-1	1	3

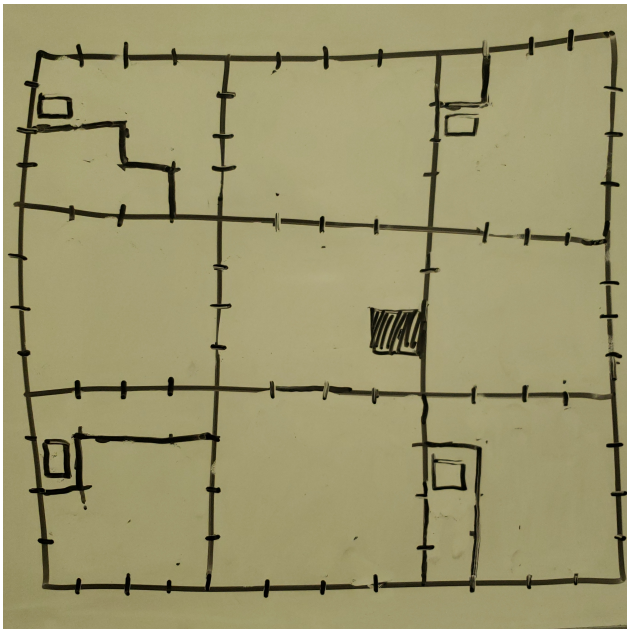
Requires entities to have odd pixel dims to be centered
Edge/vertex states are not possible
Updating position requires doubling velocity first
Store position as x and y seen on screen or relative to a square's axes?
Screen position:

- Graphics and movement are easier
- Collision would be most convenient by loading the current square rotated

Relative position:

- Collision is easier, just check against stored square
- Need to ensure that rendering is done correctly

View splitting is decided by determinant sign: will always give edge to cell further (counter?)clockwise
Vertices/edges are on the border between pixels (even position): do not require a special case



Shaded pixel: camera
Lines: region boundaries

Inlined pixels: edge cases (given to clockwise region in this case)
Going through a singularity and back is a holonomy loop
Entity gravity is ambiguous when not in the same square as the player:

- Freeze when player leaves the square: unintuitive, esp for flat regions
- Based on last player interaction: better, but initial direction must be set: could be none

Have "naked" singularities or cover them up?
Naked is easier to implement if accounted for at the cost of real physics:
an object of finite size can't actually pass through one
Not checking self-collisions would obviate this but may result in graphical glitches
Covering singularities would prevent glitches and restore accuracy but might hurt level design
Larger squares → fewer singularities → less harm in covering them
However, smaller squares → more convenient to travel/execute holonomy

Render method 1 (recursive):
Accept left+right boundary points, square to render, position/orientation of square, quadrant
Render given square in full
Check if furthest vertex given by quadrant ("splitting vertex") falls strictly within bounds
If not, call with same bounds/quadrant, single adjacent square with new position/orientation
If so, make 2 recursive calls changing appropriate bounds to splitting vertex
Store the result of the 2nd call in a separate buffer
Could maintain a stack of buffers and add depth as an argument: depth necessary anyway
Mask buffer with line between camera and splitting vertex (anti-aliasing here!)
Overlay with original buffer
4 base cases starting from current square with left/right bounds along x/y axes
Renders current square 4x and squares in same row/col 2x

Render method 2 (polygons):
Build a tree of regions, starting from current square
Region info: left and right boundary points, square rendered, position, and orientation of square
Region is split if strictly contains singularity (i.e. not on edge)
4 quadrants constructed separately, contains duplicate regions like previous method
For each position, the regions are laid on top of each other using z depth in (counter)clockwise order
Each region gets transparency based on just one separating point: layer underneath gives anti-aliasing effect
Masking areas behind opaque objects should only be done at the end:
ensure consistent behavior inside/outside square containing object

Render method 3 (pixel shader):
Build tree as in method 2, using a queue for BFS
Regions in the same position are contiguous in the queue
Store index of first region in array
Given a pixel, find position, access array for queue index, iterate through queue until pixel is in bounds
Apply orientation of region to find color

Must be regions of square accessible in only one orientation: side longer than 2x jump height

Art style between pixel and vector: each "pixel" is not a solid color but one of a few predefined shapes, e.g. solid color, 2 colors split diagonally, split by circular arc