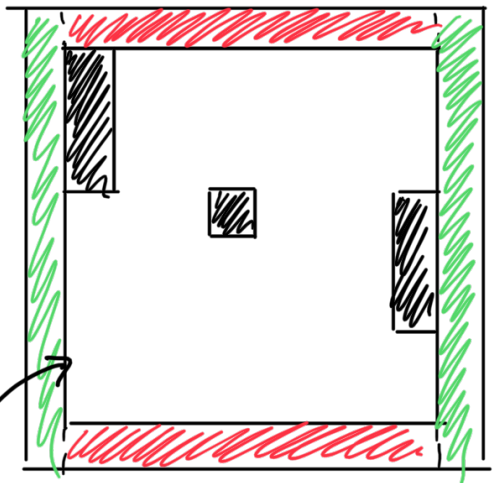
IoT Assignment 2

Ultrasonic Pong

- LED matrix pong game
- Paddles controls by Ultrasonic Sensors.

GAME GRID



Paddle 1 x 3 LEDs

Ball 1 x 1 LED

Boundary wall
→ Ball bounces off

Point Zone
→ If ball enters point is scored

Inner grid
↳ corresponds to LED matrix

8 x 8 LEDs

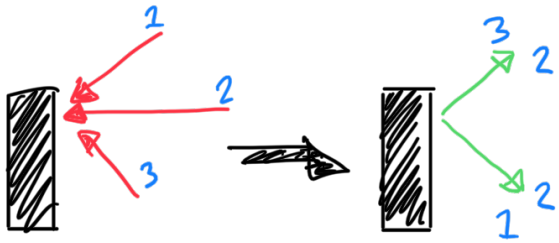
Outer section
↳ Software defined for walls and point zones.

For simplicity won't

Ball dynamics

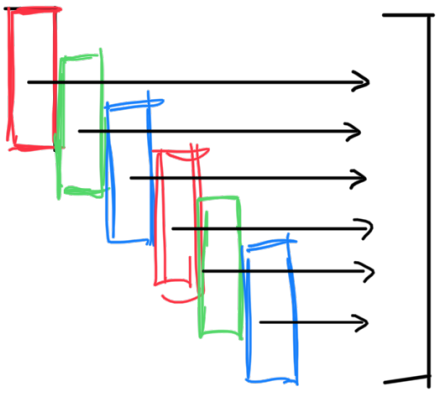
use velocity mechanics

Different behaviour dependent on incoming trajectory and paddle impact point.



2 50% chance for each

PADDLE POSITIONS



6 states

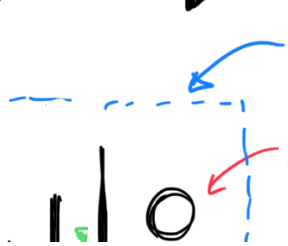
- 6 Ultrasonic sensors?

= 12 for 2 player

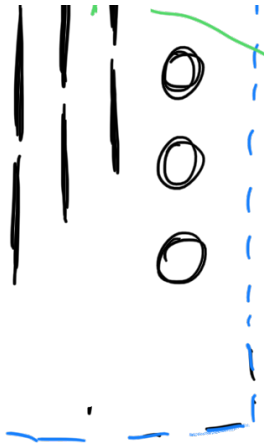
PROBLEM
I only have 10 sensors.

DESIGN 1

Could use overlap?



Coverage permutations would need to be tested for



x 4

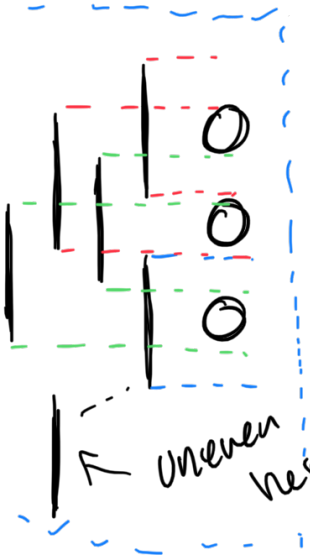
// reliability.

control panel
Can cover max 2 sensors at once

Permutations of covered sensors determines Paddle location.
1:1 mapping (ish)

↳ Can use minimum of 4 sensors, could add a 5th if reliability is an issue.

→ Could MAYBE use only 3:

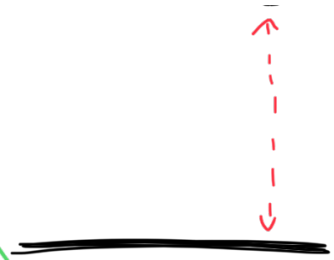


Going to use this design

DESIGN 2

Paddle controlled via distance of sensor from ground.

⊖ Only need 1 sensor

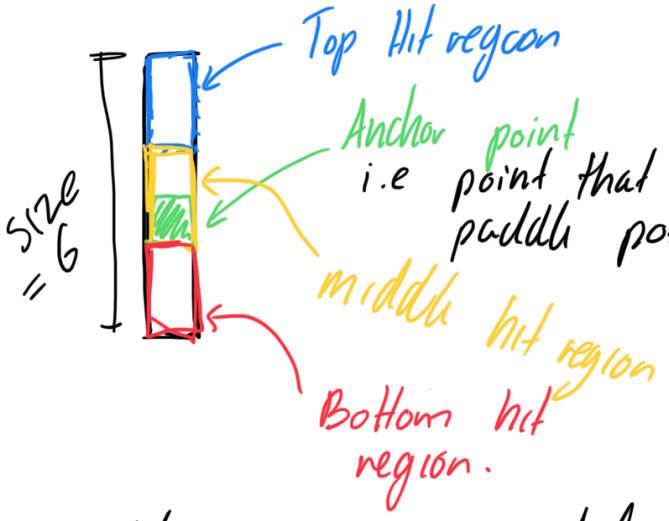


per person

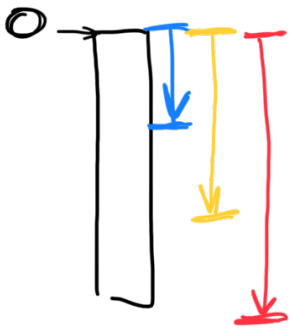
Would need calabration for people of different heights.

↳ Possible.

Paddle Collision



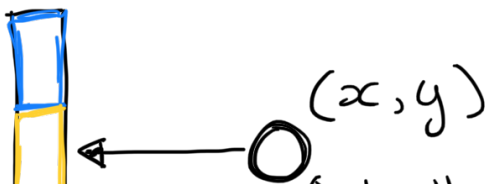
Hit regions are defined by counting from TOP:



Top = 0 + 2

middle = 0 + 4 − 2

bottom = 0 + 6 − 4



~ ball

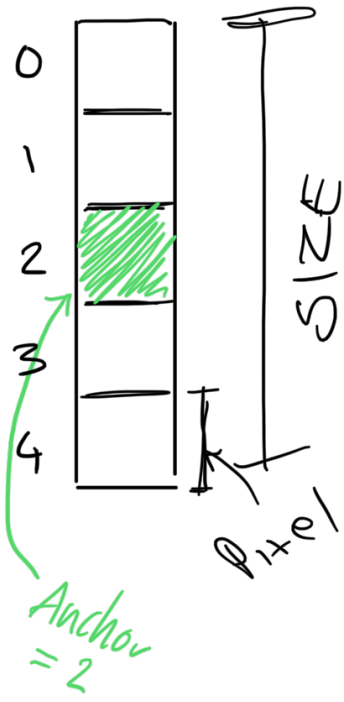
1. Check ball is inline with paddle.
   ↳ If it's not it obviously hasn't collided

2. Check ball y is within upper + lower bounds of paddle

Size = 5 pixels

Anchor pixel index = 2

Anchor y coord = A_y



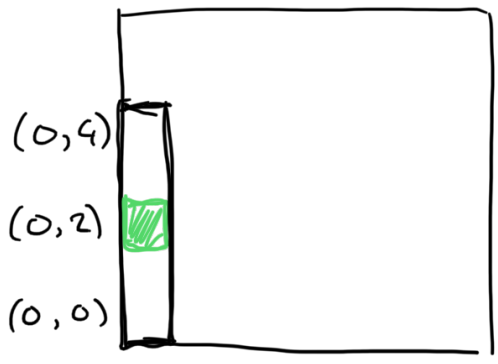
$y_{min} = A_y - 2$

$y_{max} = A_y + 2$

e.g Anchor Pixel Coord = (0, 2)

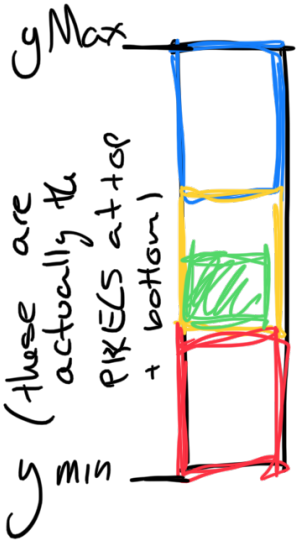
$y_{min} = 2 - 2 = 0$

$y_{max} = 2 + 2 = 4$



UPPER and LOWER BOUNDS CALCULATION

3. Identify the region that was hit



TOP

Ball.y <= yMax AND > yMax - topSize

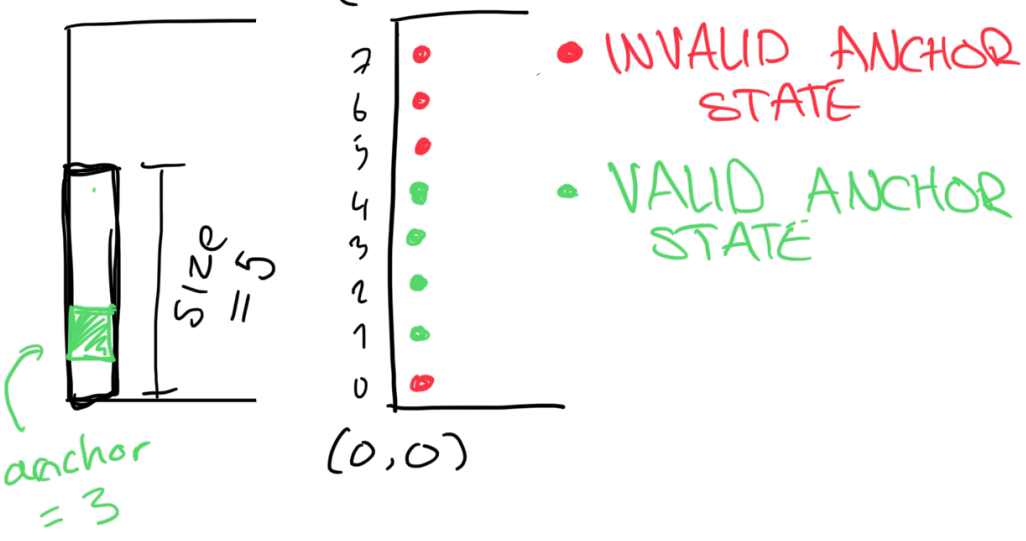
MIDDLE

yMax - (topSize + middle) < Ball.y <= (yMax - topSize)

BOTTOM

else bottom

Valid paddle positions for any defined Paddle and board size



Valid ~~States~~ = 1, 2, 3, 4
(y values)

$$Interval = \left[0 + ((Size - 1) - anchor) \right.$$
$$\left. yMax - anchor \right]$$