Lecture #16. 스크롤링

2D 게임 프로그래밍

이대현 교수

한국공학대학교
TECH UNIVERSITY OF KOREA

학습 내용

- 스크롤링
- 타일맵 기반 스크롤링
- 무한 스크롤링
- 시차 스크롤링

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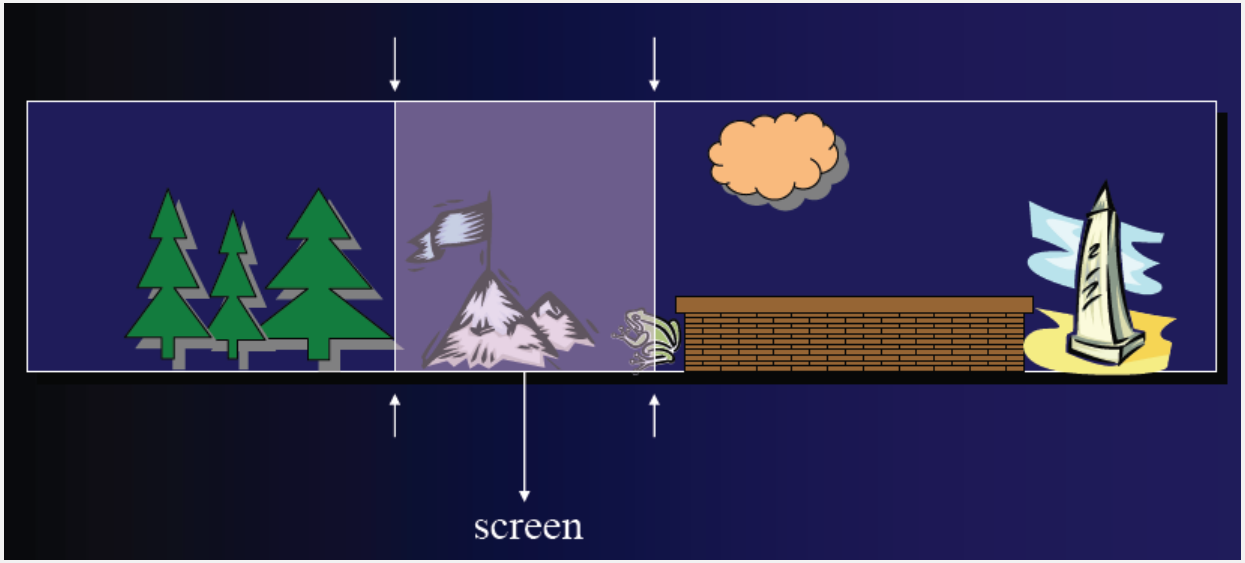
스크롤링(Scrolling)

- 그림이나 이미지의 일부분을 디스플레이 화면 위에서 상하좌우로 움직이면서 나타내는 기법.



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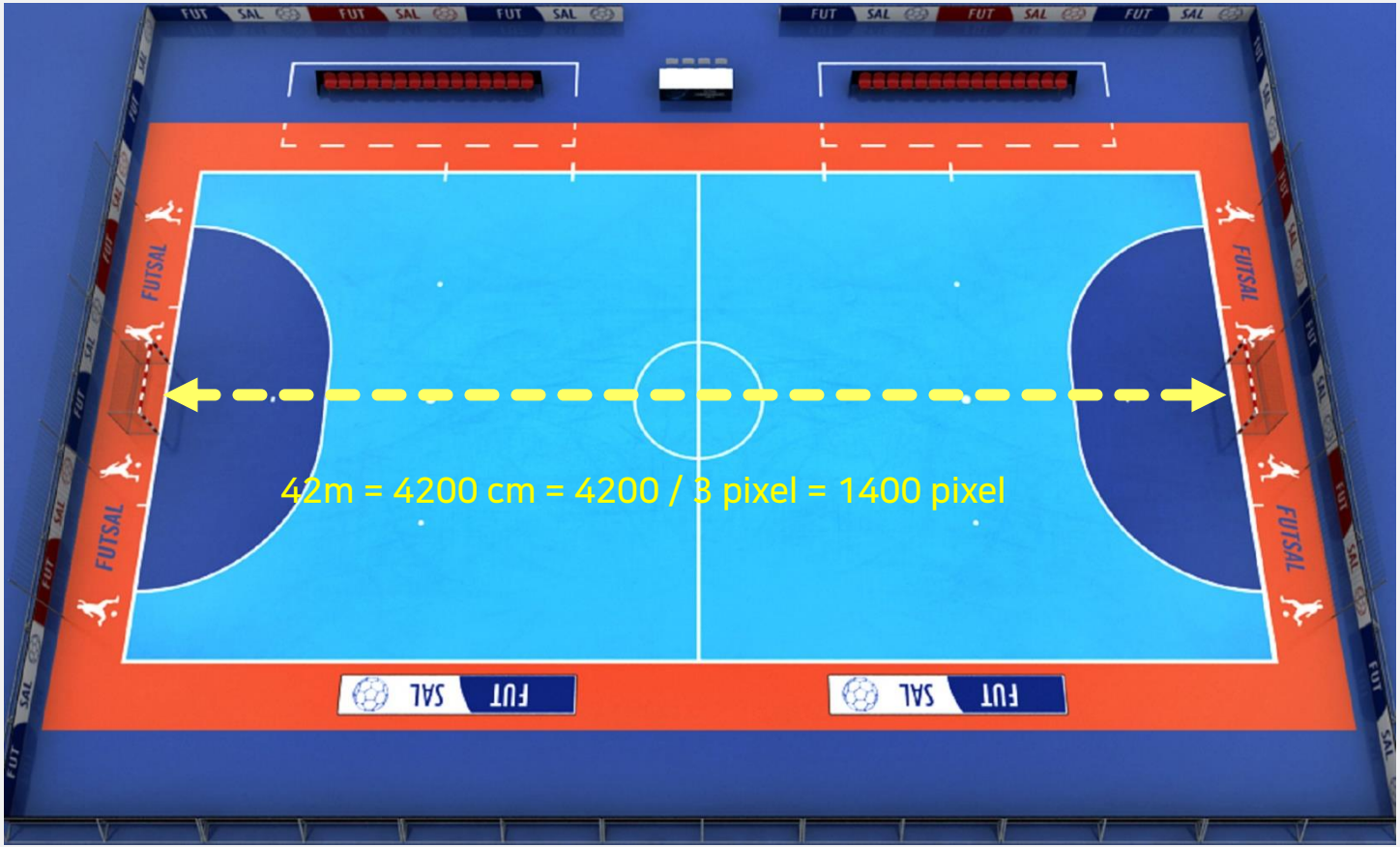
게임 맵은 반드시 실제 물리값으로 크기가 표시되어야 함.



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실제 좌표와 스크린 좌표를 분리 처리

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스크린 윈도우를 이용한 스크롤링

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window_left, window_bottom

x-canvas_width//2, y-canvas_height//2)

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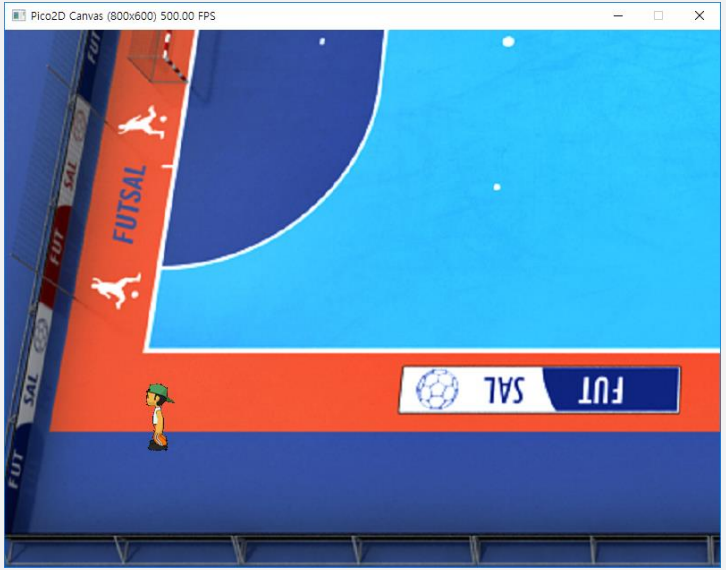

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상하좌우 스크롤링

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clamp 함수

```
def clamp(minimum, x, maximum):
    return max(minimum, min(x, maximum))
```


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play_state.py

```
from boy import Boy
# fill here
from background import FixedBackground as Background
```


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background.py

```
class FixedBackground:

def draw(self):
    self.image.clip_draw_to_origin(
        self.window_left, self.window_bottom,
        self.canvas_width, self.canvas_height,
        0, 0)


def update(self, frame_time):
    self.window_left = clamp(0,
        int(self.center_object.x) - self.canvas_width//2,
        self.w - self.canvas_width - 1)
    self.window_bottom = clamp(0,
        int(self.center_object.y) - self.canvas_height//2,
        self.h - self.canvas_height - 1)
```


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boy.py (1)

```
def do(boy):
    boy.frame = (boy.frame + FRAMES_PER_ACTION * ACTION_PER_TIME *
game_framework.frame_time) % FRAMES_PER_ACTION
    boy.x += boy.x_velocity * game_framework.frame_time
    boy.y += boy.y_velocity * game_framework.frame_time

    # fill here
    boy.x = clamp(0, boy.x, server.background.w-1)
    boy.y = clamp(0, boy.y, server.background.h-1)
```


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boy.py (2)

```
def draw(boy):
    sx, sy = boy.x - server.background.window_left, boy.y - server.background.window_bottom

    boy.font.draw(sx - 40, sy + 40, '(%d, %d)' % (boy.x, boy.y), (255, 255, 0))
```


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background.py

```
class FixedBackground:


def draw(self):
    self.image.clip_draw_to_origin(
        self.window_left, self.window_bottom,
        self.canvas_width, self.canvas_height,
        0, 0)


def update(self, frame_time):
    self.window_left = clamp(0,
        int(server.boy.x) - self.canvas_width//2,
        self.w - self.canvas_width - 1)
    self.window_bottom = clamp(0,
        int(server.boy.y) - self.canvas_height//2,
        self.h - self.canvas_height - 1)
```

window의 left x 좌표의 최대값은,전체 배경 너비에서 화면의 너비를 뺀 값.

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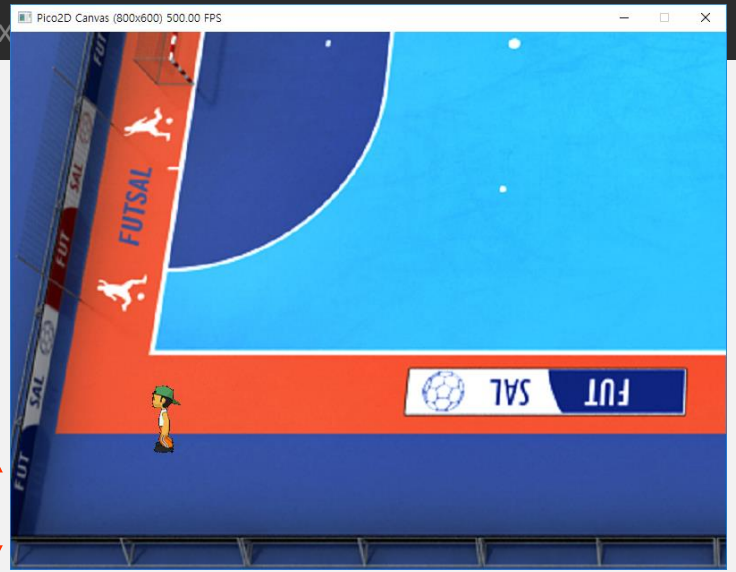
```
def draw(boy):
    sx, sy = boy.x - server.background.window_left, boy.y - server.background.window_bottom

    boy.font.draw(sx - 40, sy + 40, '(%d, %d)' % (boy.x
```



y - window_bottom

x - window_left

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실습

상하좌우 스크롤링 (타일링 배경)

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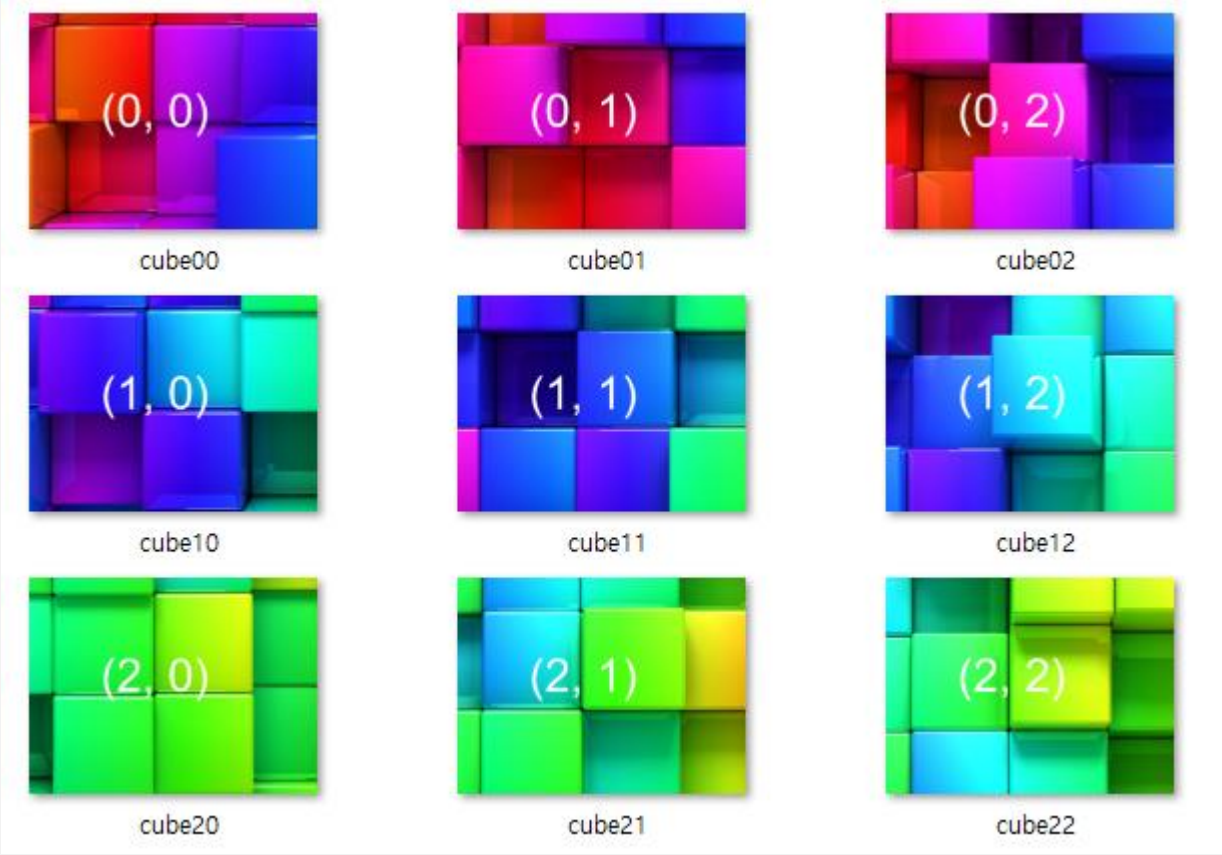
Tile image



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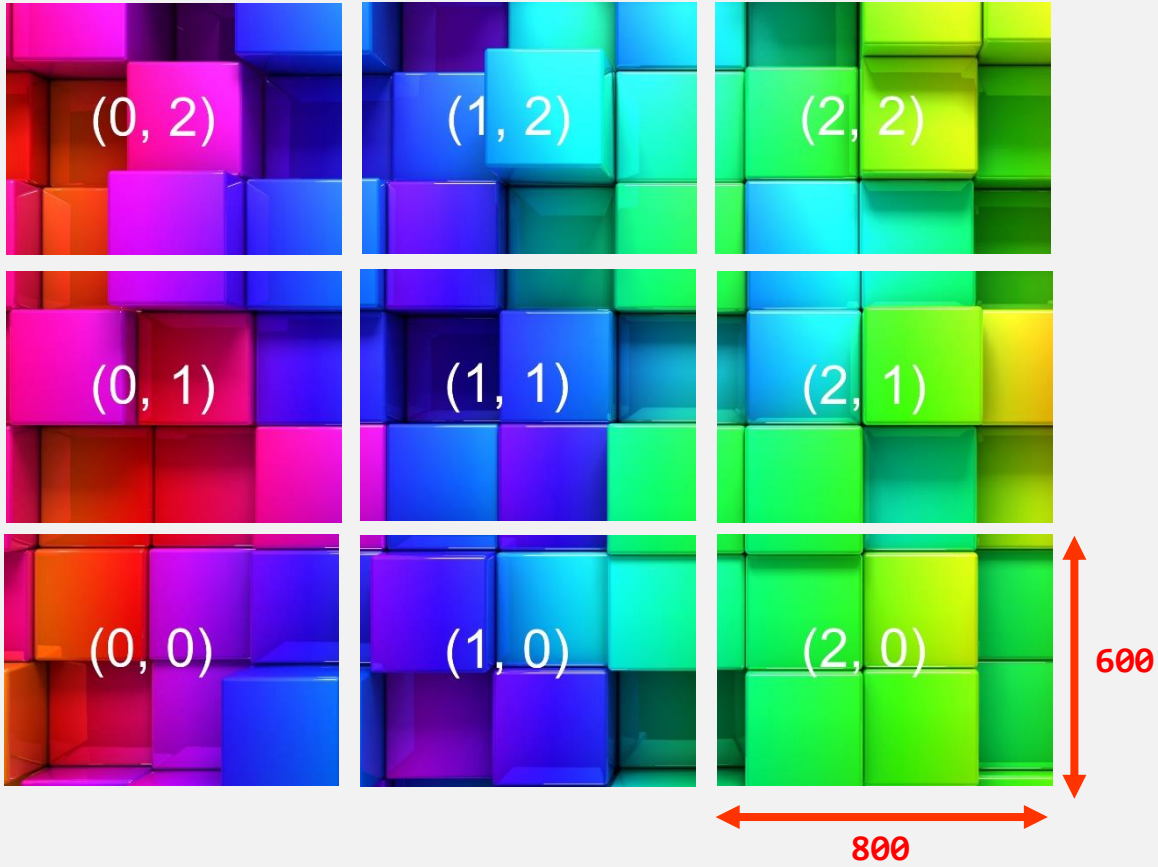
타일맵 구조



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main_state.py

```
from boy import Boy
# fill here
from background import TileBackground as Background
```


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background.py (1)

```
class TileBackground:

    def __init__(self):
        self.canvas_width = get_canvas_width()
        self.canvas_height = get_canvas_height()
        self.w = 800 * 3
        self.h = 600 * 3

        self.tiles = [ [ load_image('cube%d%d.png' % (x, y)) for x in range(3) ] for y in range(3) ]
```


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background.py (2)

```
def draw(self):
    self.window_left = clamp(0,
                             int(server.boy.x) - self.canvas_width // 2,
                             self.w - self.canvas_width - 1)
    self.window_bottom = clamp(0,
                               int(server.boy.y) - self.canvas_height // 2,
                               self.h - self.canvas_height - 1)


    tile_left = (self.window_left // 800) % 3
    tile_right = ((self.window_left + self.canvas_width) // 800) % 3
    left_offset = self.window_left % 800

    tile_bottom = (self.window_bottom // 600) % 3
    tile_top = ((self.window_bottom + self.canvas_height) // 600) % 3
    bottom_offset = self.window_bottom % 600

    for ty in range(tile_bottom, tile_top+1):
        for tx in range(tile_left, tile_right+1):
            self.tiles[ty][tx].draw_to_origin(-left_offset + (tx-tile_left)*800, -bottom_offset+(ty-tile_bottom)*600)
```


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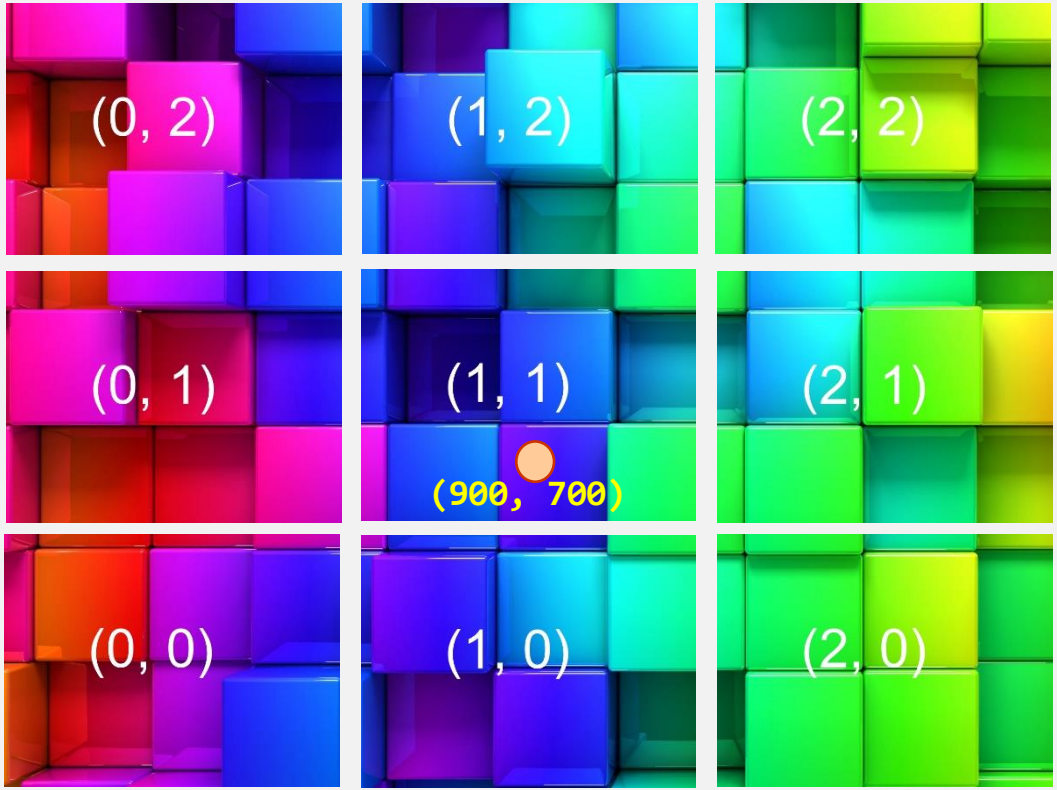
전체 맵 좌표로부터, 타일맵 좌표의 계산




```
tx = 900 // 800
ty = 700 // 600
```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실습

상하좌우 무한 스크롤링

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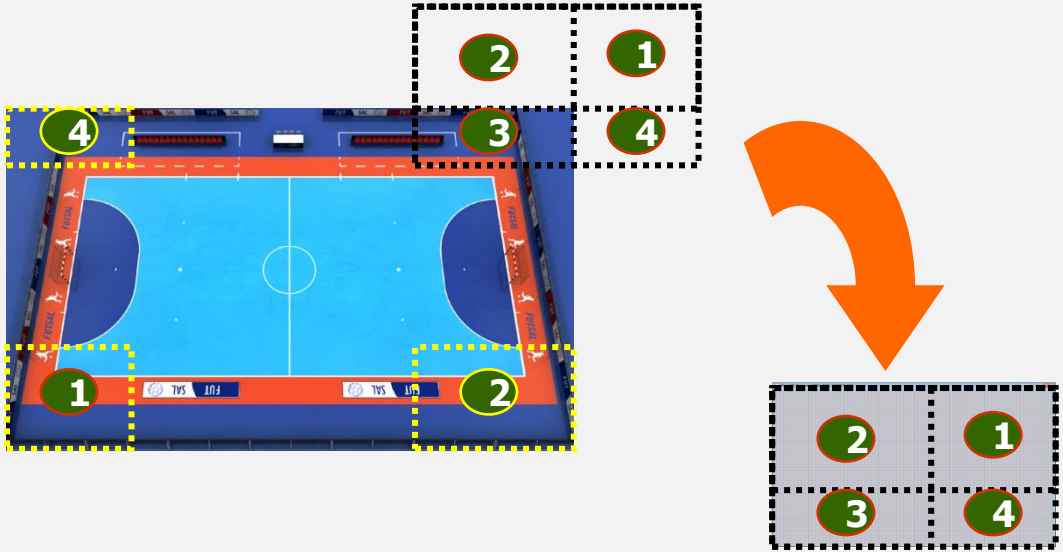
상하좌우 무한스크롤링 공식



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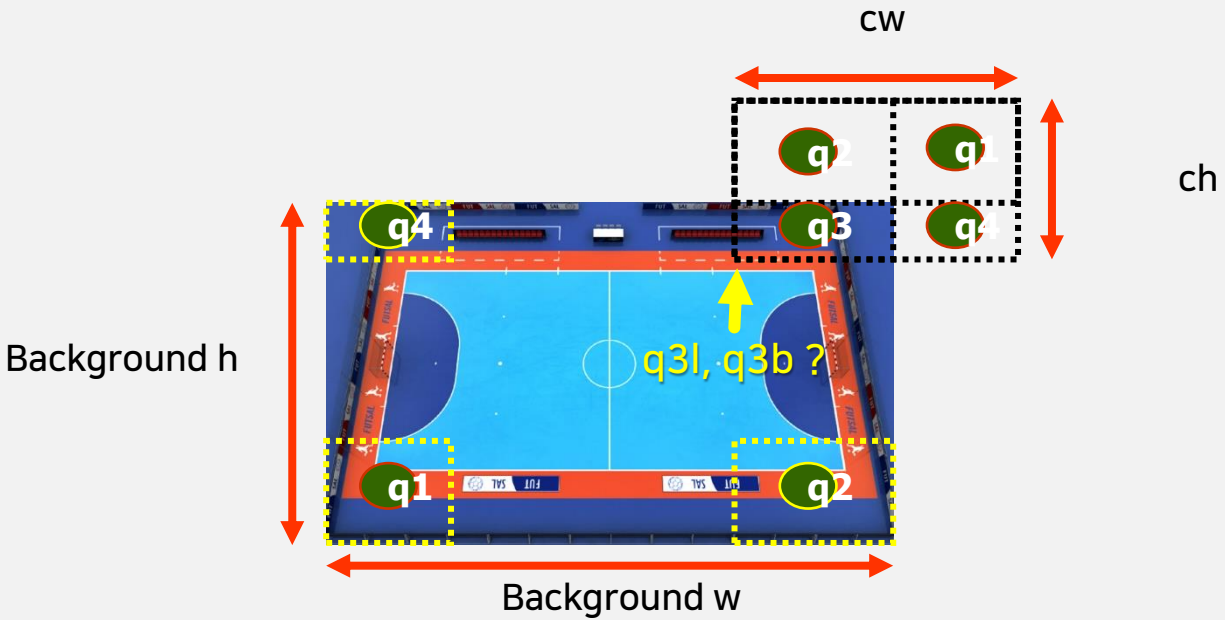

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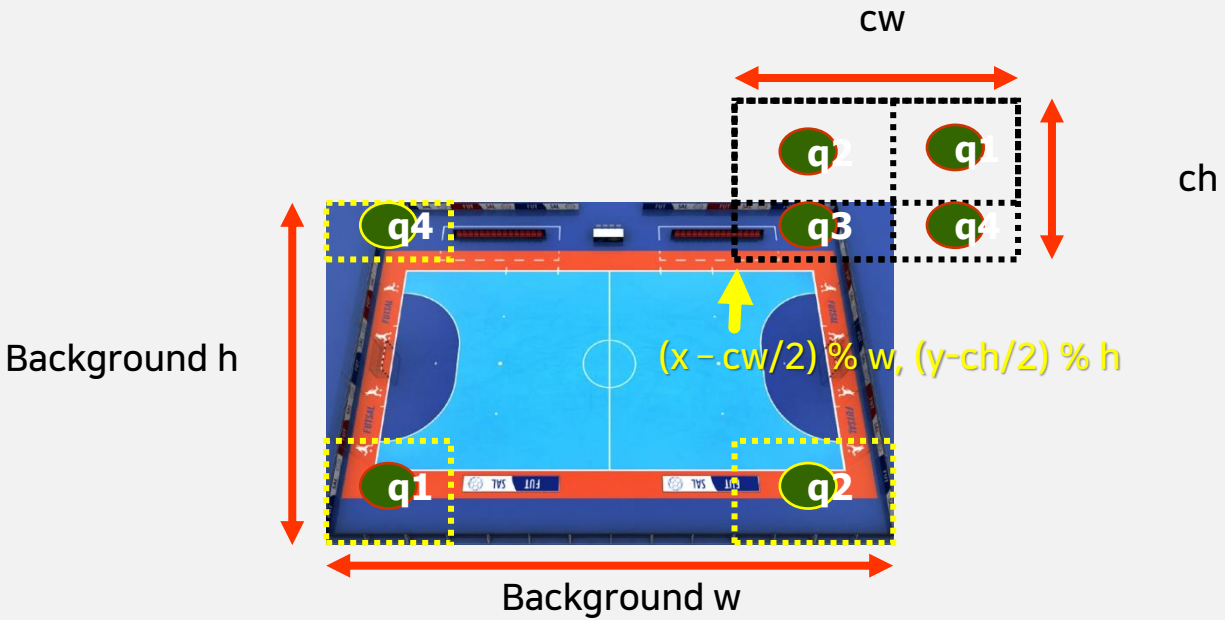

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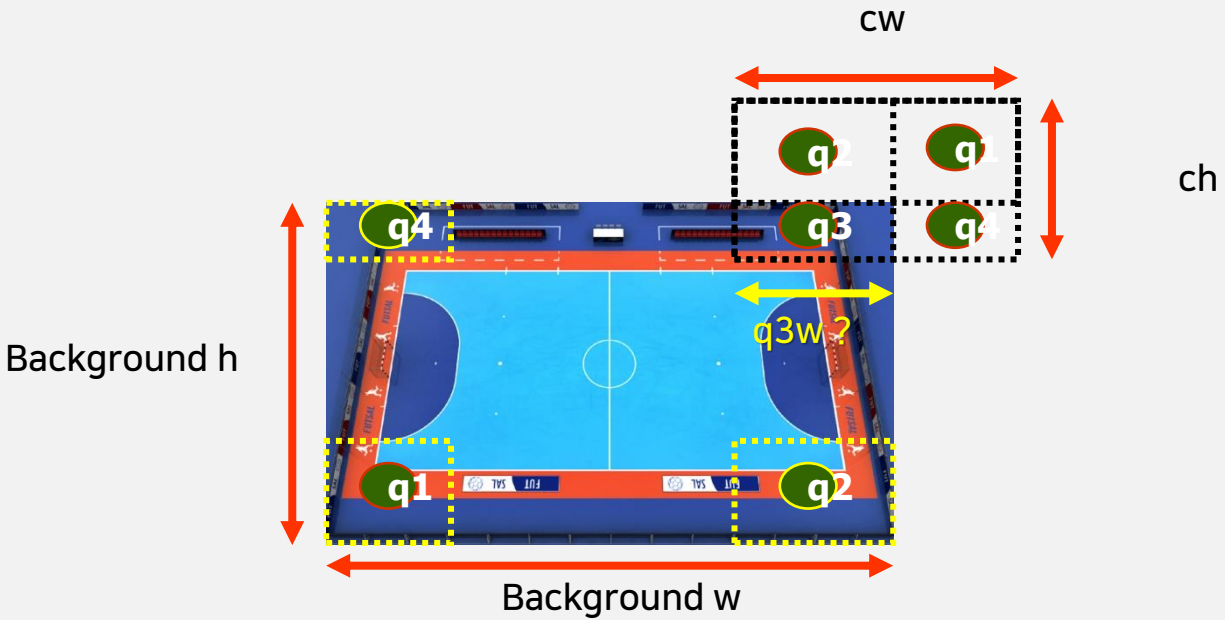

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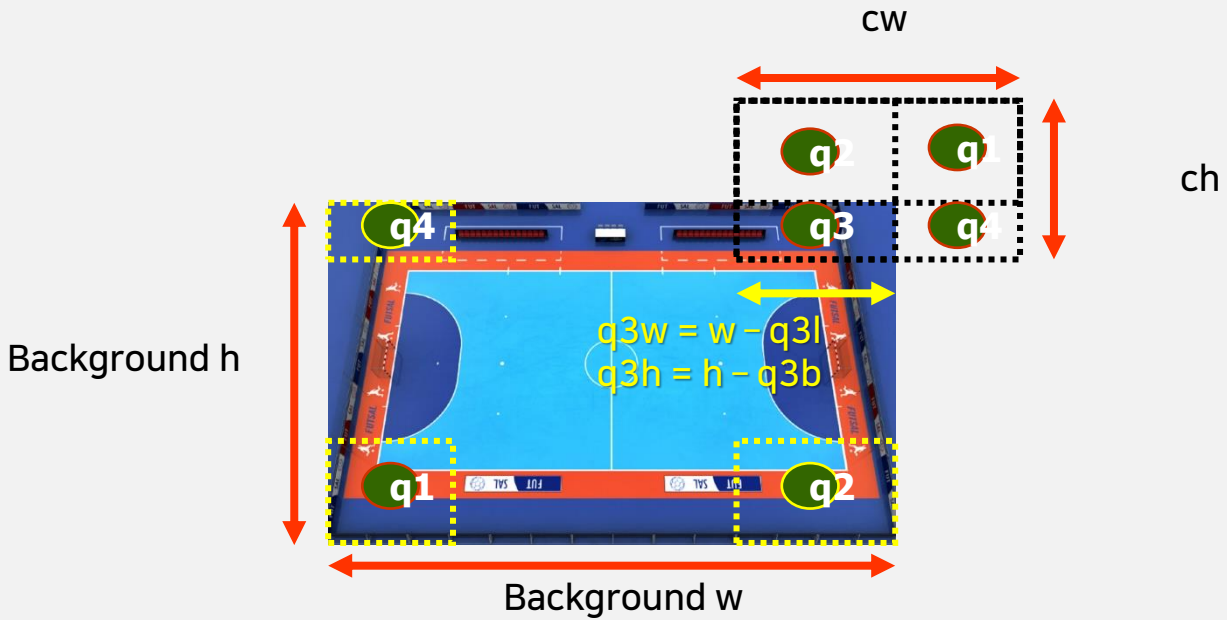

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main_state.py

```
# from background import TileBackground as Background
# from background import FixedBackground as Background
from background import InfiniteBackground as Background
```


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boy.py

```
def update(self):
    self.cur_state.do(self)
    if len(self.event_que) > 0:
        event = self.event_que.pop()
        self.cur_state.exit(self, event)
        self.cur_state = next_state_table[self.cur_state][event]
        self.cur_state.enter(self, event)

    # fill here
    self.x = clamp(50, self.x, server.background.w-50)
    self.y = clamp(50, self.y, server.background.h-50)
```

```
def draw(boy):
    sx, sy = server.background.canvas_width // 2, server.background.canvas_height // 2
    # sx, sy = boy.x - server.background.window_left, boy.y - server.background.window_bottom
```


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background.py

```
class InfiniteBackground:

    def update(self, frame_time):

        # quadrant 3
        self.q3l = (int(server.boy.x) - self.canvas_width // 2) % self.w
        self.q3b = (int(server.boy.y) - self.canvas_height // 2) % self.h
        self.q3w = clamp(0, self.w - self.q3l, self.w)
        self.q3h = clamp(0, self.h - self.q3b, self.h)

        #     quadrant 2
        self.q2l = ?
        self.q2b = ?
        self.q2w = ?
        self.q2h = ?

        #     quadrant 4
        self.q4l = ?
        self.q4b = ?
        self.q4w = ?
        self.q4h = ?

        #     quadrant 1
        self.q1l = ?
        self.q1b = ?
        self.q1w = ?
        self.q1h = ?
```


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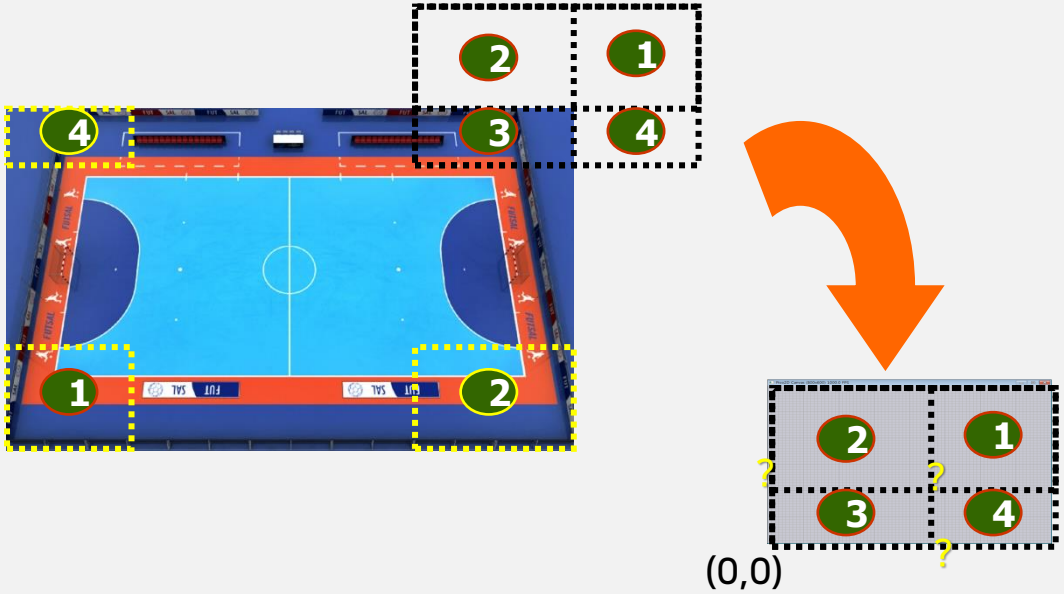
상하좌우 무한스크롤링 공식



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background.py

```
class InfiniteBackground:

    def draw(self):
        self.image.clip_draw_to_origin(self.q3l, self.q3b, self.q3w, self.q3h, 0, 0)
        self.image.clip_draw_to_origin(self.q2l, self.q2b, self.q2w, self.q2h, ?, ?)
        self.image.clip_draw_to_origin(self.q4l, self.q4b, self.q4w, self.q4h, ?, ?)
        self.image.clip_draw_to_origin(self.q1l, self.q1b, self.q1w, self.q1h, ?, ?)
```


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시차(視差) 스크롤링(Parallax Scrolling)

- 물체와 눈의 거리에 따라, 물체의 이동속도가 달라보이는 효과를 이용하여, 3차원 배경을 흉내 내는 기법.

- 1982년 “Moon Patrol”이라는 게임에서 세계 최초로 사용됨.

• 밤하늘, 뒷산, 앞산의 스크롤링 속도를 다르게 함으로써, 3차원적인 깊이 효과를 구현.

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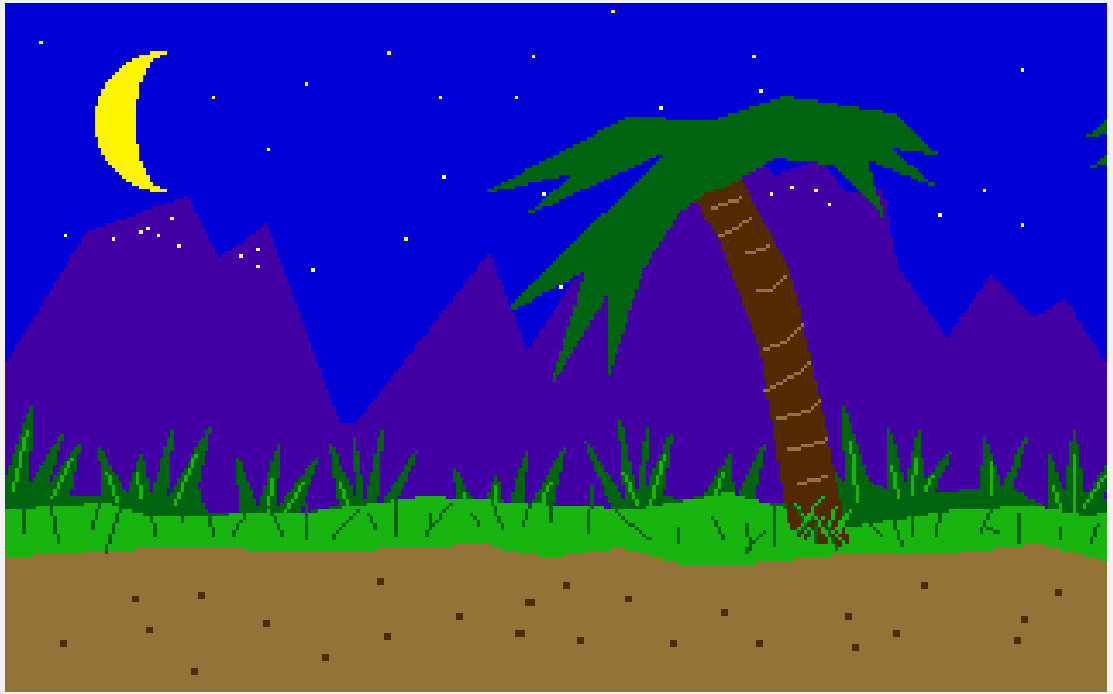

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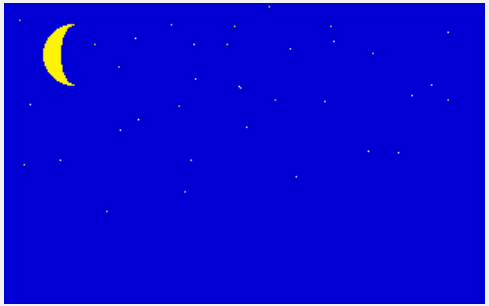
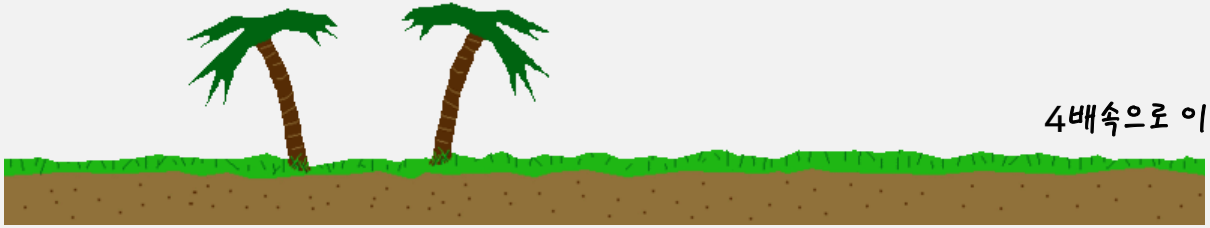
시차 스크롤링 방법



1배속으로 이동

2배속으로 이동

3배속으로 이동



4배속으로 이동

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정답

```
def draw(self):
    self.image.clip_draw_to_origin(self.q3l, self.q3b, self.q3w, self.q3h, 0, 0)                       # quadrant 3
    self.image.clip_draw_to_origin(self.q2l, self.q2b, self.q2w, self.q2h, 0, self.q3h)                # quadrant 2
    self.image.clip_draw_to_origin(self.q4l, self.q4b, self.q4w, self.q4h, self.q3w, 0)                # quadrant 4
    self.image.clip_draw_to_origin(self.q1l, self.q1b, self.q1w, self.q1h, self.q3w, self.q3h)         # quadrant 1

def update(self):
    # quadrant 3
    self.q3l = (int(server.boy.x) - self.canvas_width // 2) % self.w
    self.q3b = (int(server.boy.y) - self.canvas_height // 2) % self.h
    self.q3w = clamp(0, self.w - self.q3l, self.w)
    self.q3h = clamp(0, self.h - self.q3b, self.h)
    # quadrant 2
    self.q2l = self.q3l
    self.q2b = 0
    self.q2w = self.q3w
    self.q2h = self.canvas_height - self.q3h
    # quadrand 4
    self.q4l = 0
    self.q4b = self.q3b
    self.q4w = self.canvas_width - self.q3w
    self.q4h = self.q3h
    # quadrand 1
    self.q1l = 0
    self.q1b = 0
    self.q1w = self.q4w
    self.q1h = self.q2h
```


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