

# Lecture #15. 스크롤링

2D 게임 프로그래밍

이대현 교수

# 학습 내용

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- 게임 맵
- 스크롤링
- 무한 스크롤링
- 시차 스크롤링

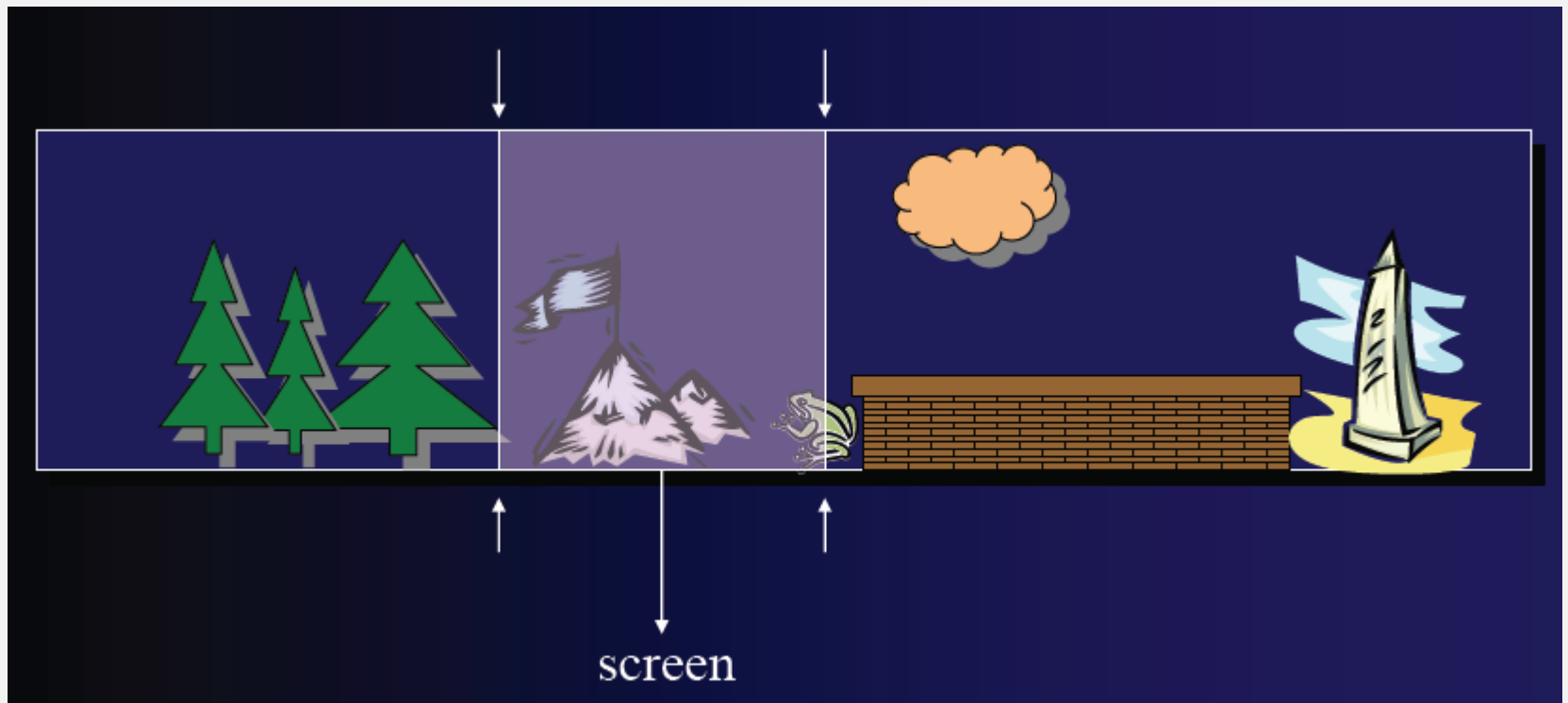
게임 맵은 반드시 실제 물리값으로 크기가 표시되어야 함.





# 스크롤링(Scrolling)

- 그림이나 이미지의 일부분을 디스플레이 화면 위에서 상하좌우로 움직이면서 나타내는 기법.
- 슈팅 게임, 고전 RPG 게임에서 주로 사용됨.



# 카메라 윈도우를 이용한 스크롤링

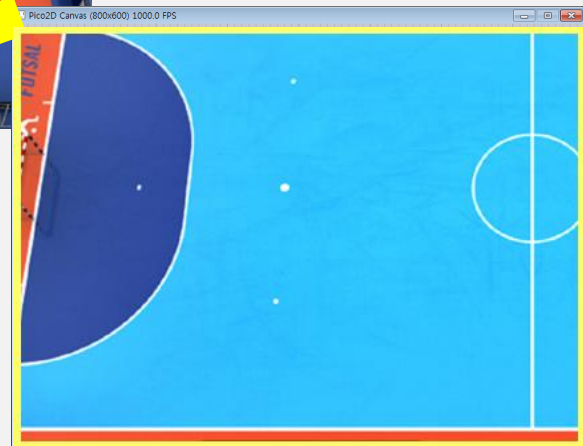
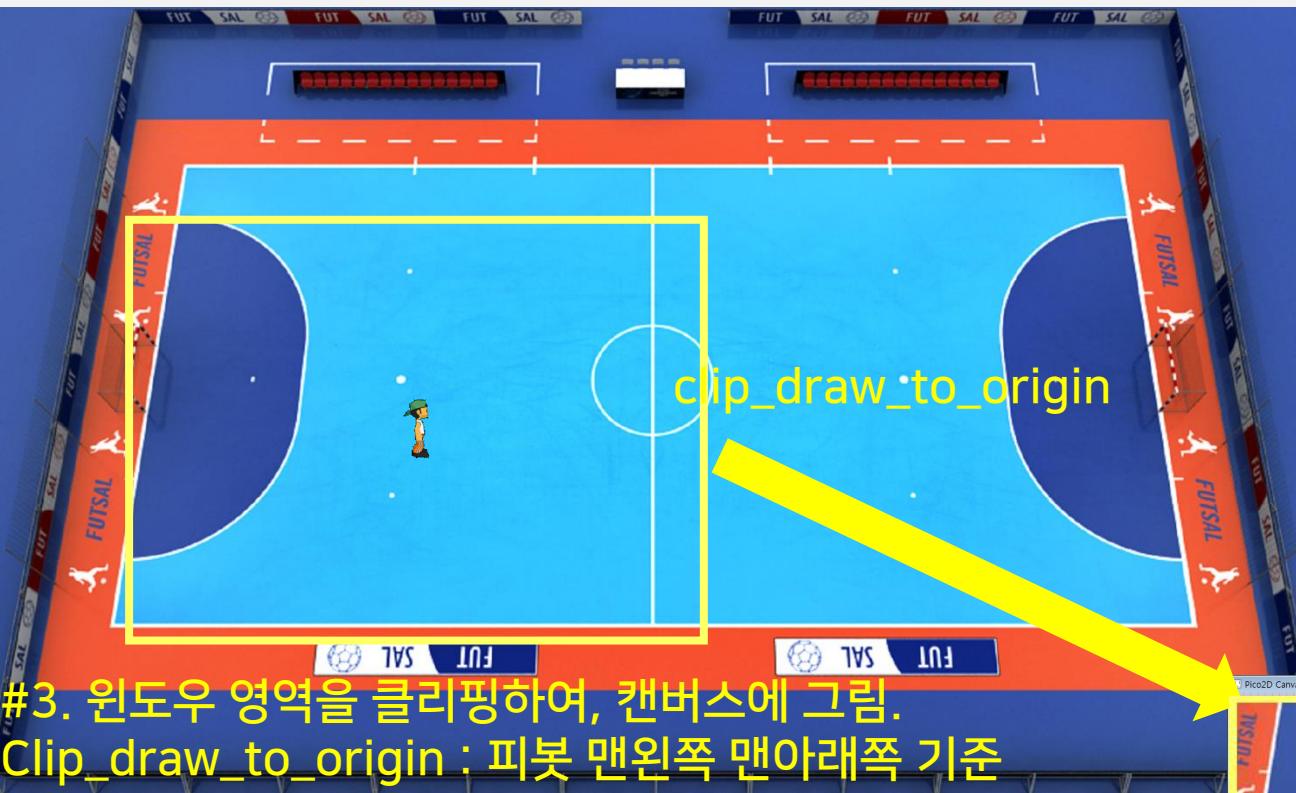






#2. 플레이어를 가운데에 놓고, 카메라 윈도우를 계산

$(x\text{-canvas\_width}/2, y\text{-canvas\_height}/2)$





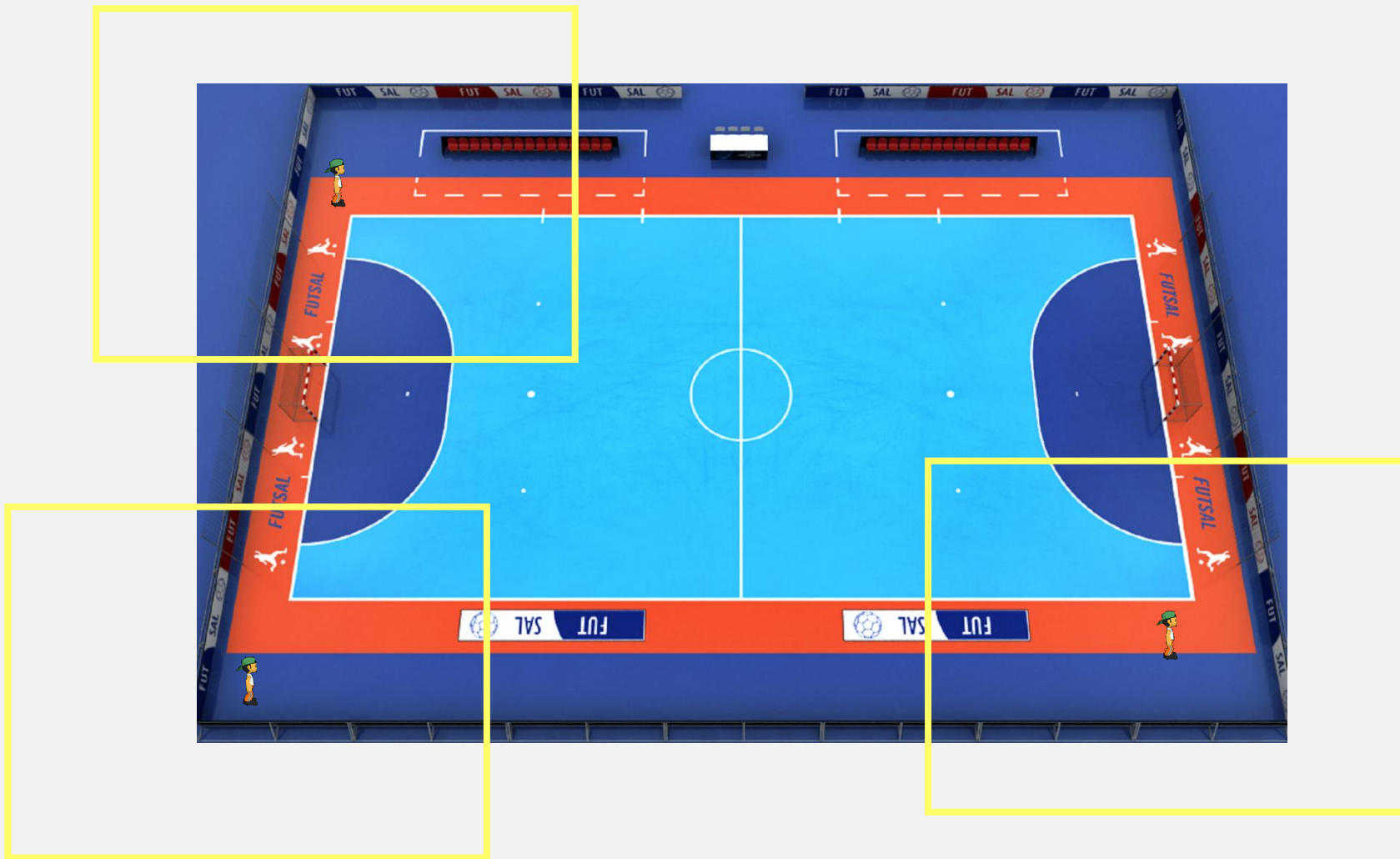


#4. 플레이어를 캔버스에 그림.

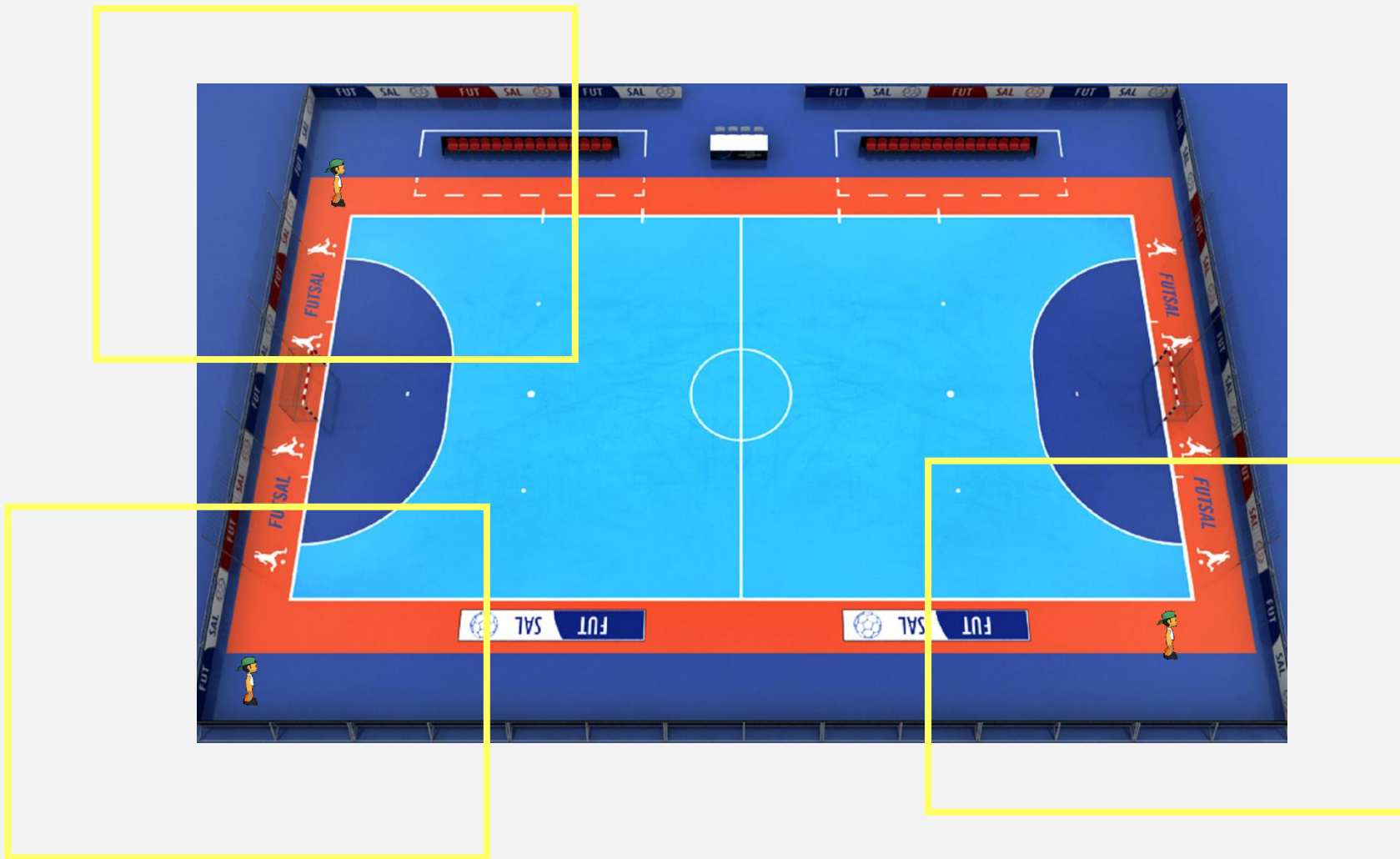


( $\text{canvas\_width} // 2$ ,  $\text{canvas\_height} // 2$ )

# 벗어날 경우?



# 벗어날 경우?



시스템



상하좌우 스크롤링!

## clamp 함수

---

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



```
from boy import Boy
from background import FixedBackground as Background

def enter():
    global boy
    boy = Boy()
    game_world.add_object(boy, 1)

    global background
    background = Background()
    game_world.add_object(background, 0)

    background.set_center_object(boy)
    boy.set_background(background)
```





```
class FixedBackground:
```

```
def set_center_object(self, boy):  
    self.center_object = boy
```

```
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)  
    self.window_bottom = clamp(0,  
        int(self.center_object.y) - self.canvas_height//2,  
        self.h - self.canvas_height)
```

# boy.py (1)



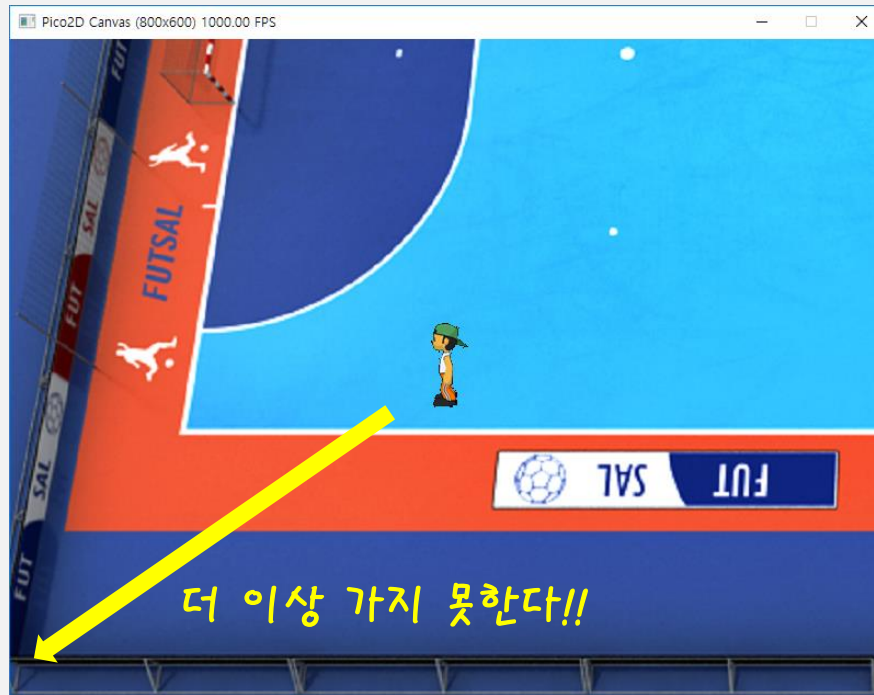
```
@staticmethod
def do(boy):
    boy.frame = (boy.frame + FRAMES_PER_ACTION * ACTION_PER_TIME *
                  game_framework.frame_time) % FRAMES_PER_ACTION
    boy.x += boy.x_velocity * game_framework.frame_time
    boy.y += boy.y_velocity * game_framework.frame_time

    boy.x = clamp(boy.canvas_width // 2, boy.x, boy.bg.w - boy.canvas_width // 2)
    boy.y = clamp(boy.canvas_height // 2, boy.y, boy.bg.h - boy.canvas_height // 2)
```

# boy.py (2)



```
@staticmethod
def draw(boy):
    cx, cy = boy.canvas_width//2, boy.canvas_height//2
    if boy.x_velocity > 0:
        boy.image.clip_draw(int(boy.frame) * 100, 100, 100, 100, cx, cy)
        boy.dir = 1
    elif boy.x_velocity < 0:
        boy.image.clip_draw(int(boy.frame) * 100, 0, 100, 100, cx, cy)
        boy.dir = -1
    else:
        # if boy x_velocity == 0
        if boy.y_velocity > 0 or boy.y_velocity < 0:
            if boy.dir == 1:
                boy.image.clip_draw(int(boy.frame) * 100, 100, 100, 100, cx, cy)
            else:
                boy.image.clip_draw(int(boy.frame) * 100, 0, 100, 100, cx, cy)
        else:
            # boy is idle
            if boy.dir == 1:
                boy.image.clip_draw(int(boy.frame) * 100, 300, 100, 100, cx, cy)
            else:
                boy.image.clip_draw(int(boy.frame) * 100, 200, 100, 100, cx, cy)
```



# 플레이어의 화면상의 좌표 계산





```
@staticmethod
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

    boy.x = clamp(0, boy.x, boy.bg.w)
    boy.y = clamp(0, boy.y, boy.bg.h)

@staticmethod
def draw(boy):
    cx, cy = boy.x - boy.bg.window_left, boy.y - boy.bg.window_bottom
    if boy.x_velocity > 0:
```

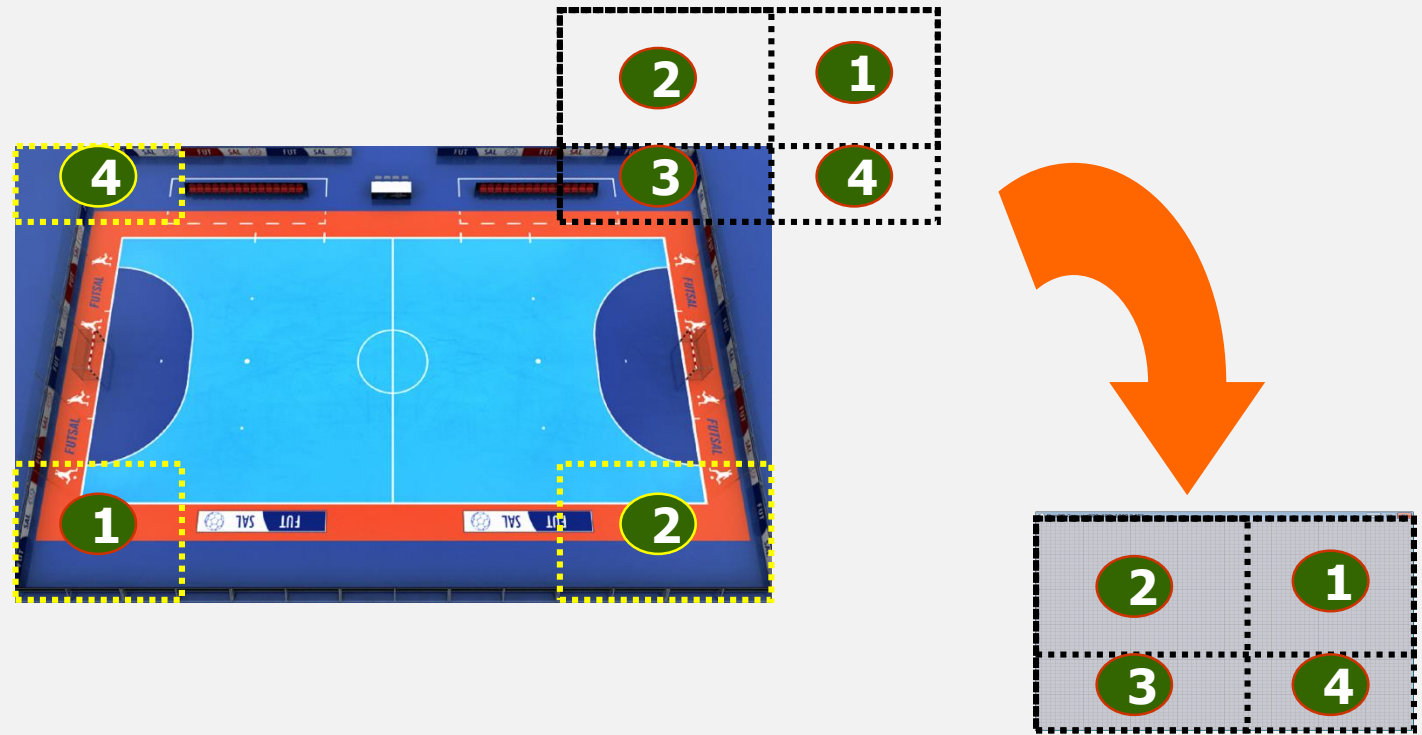


시스템

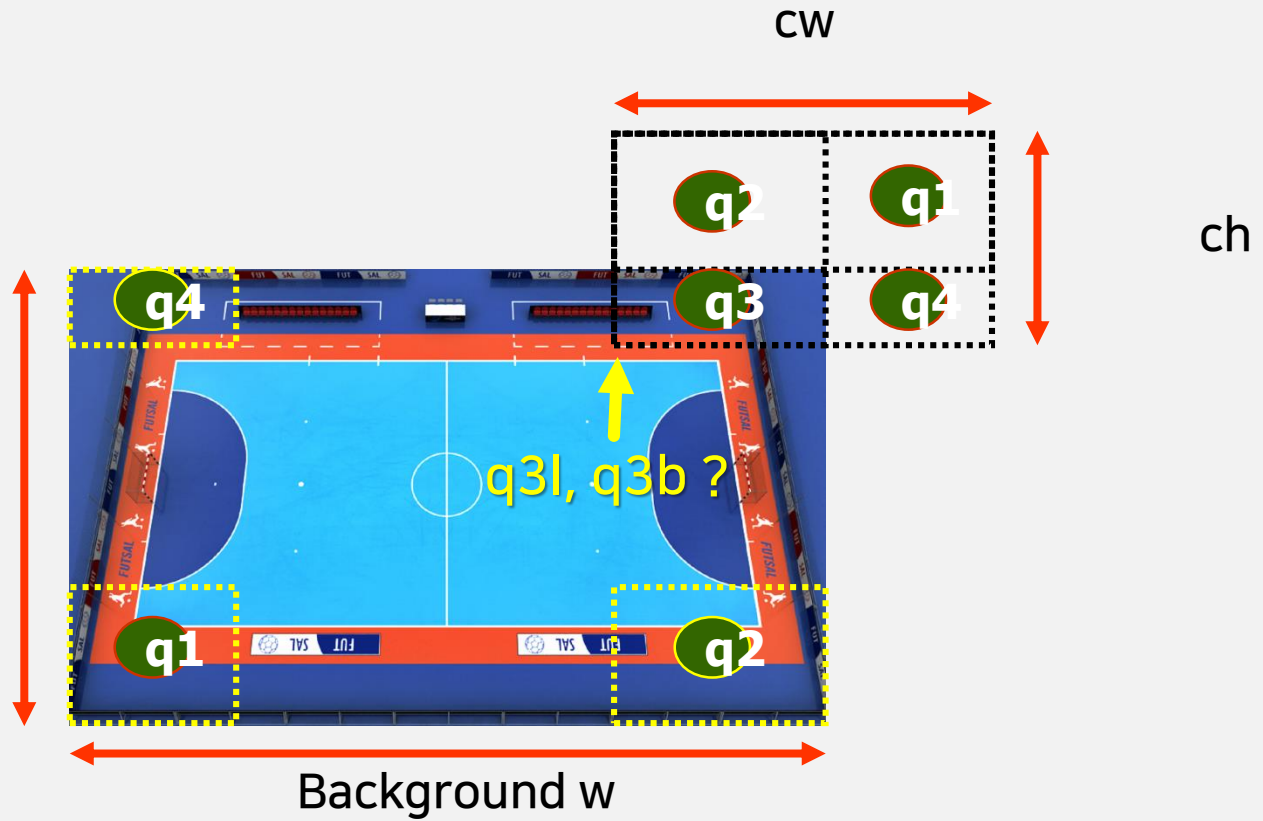


상하좌우 무한 스크롤링

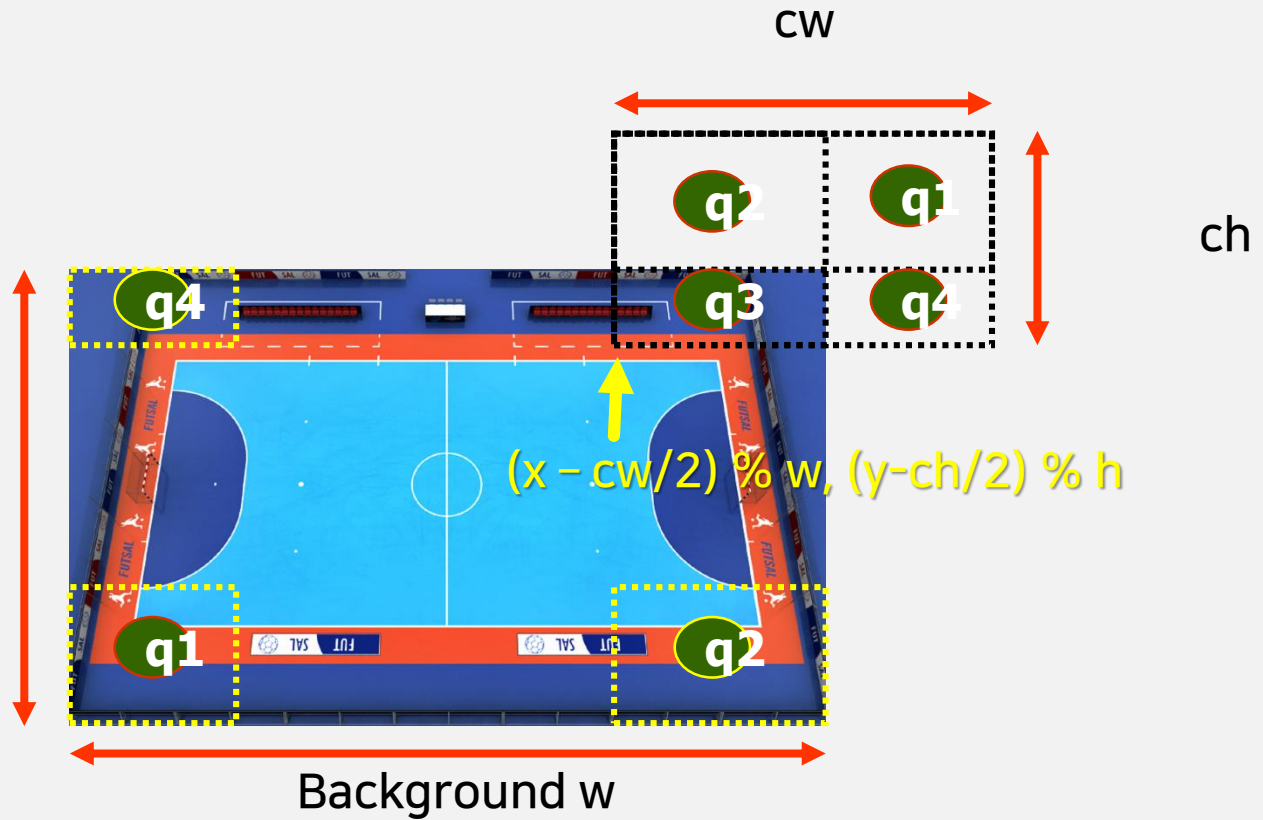
# 상하좌우 무한스크롤링 공식



Background h

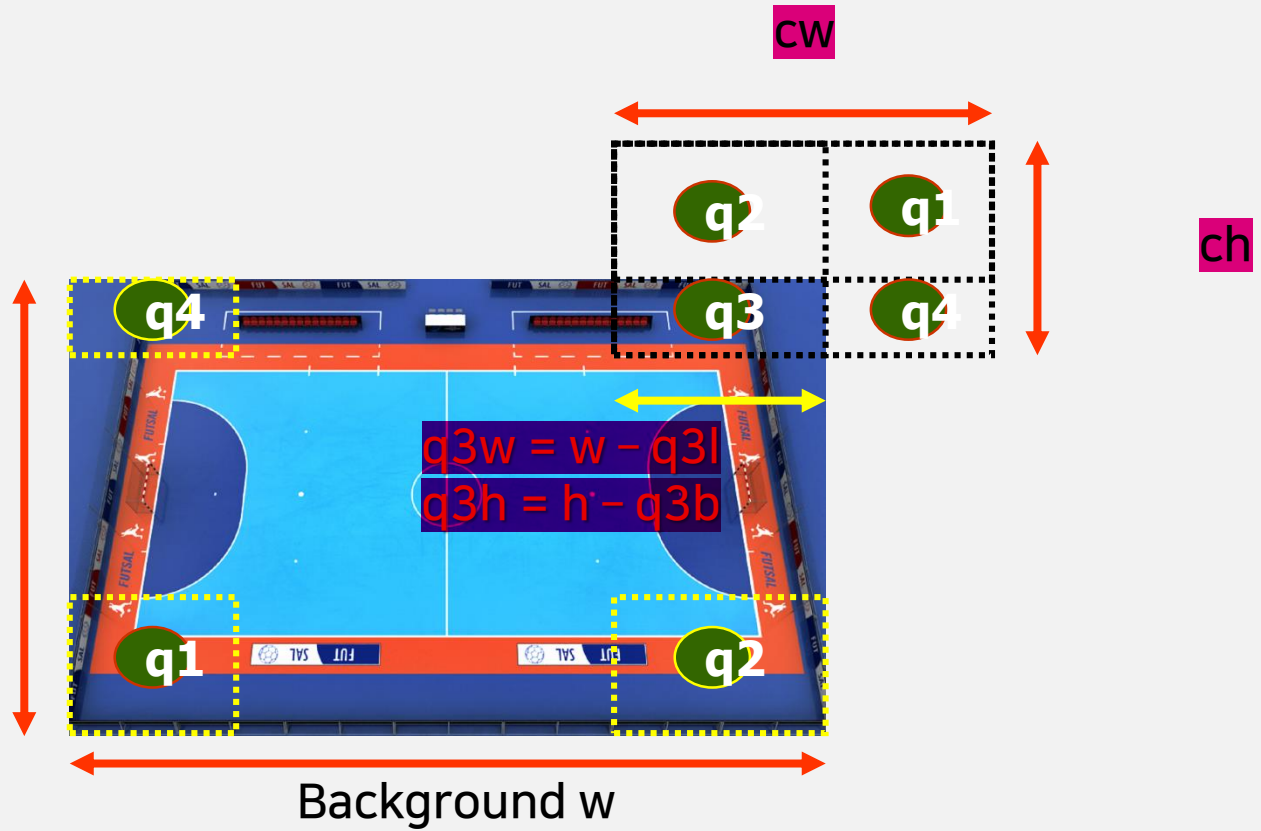


Background h





Background h







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



```
@staticmethod
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
```

```
boy.x = clamp(0, boy.x, boy.bg.w)
boy.y = clamp(0, boy.y, boy.bg.h)
```

```
@staticmethod
def draw(boy):
    cx, cy = boy.canvas_width//2, boy.canvas_height//2
    if boy.x_velocity > 0:
```



## class InfiniteBackground:

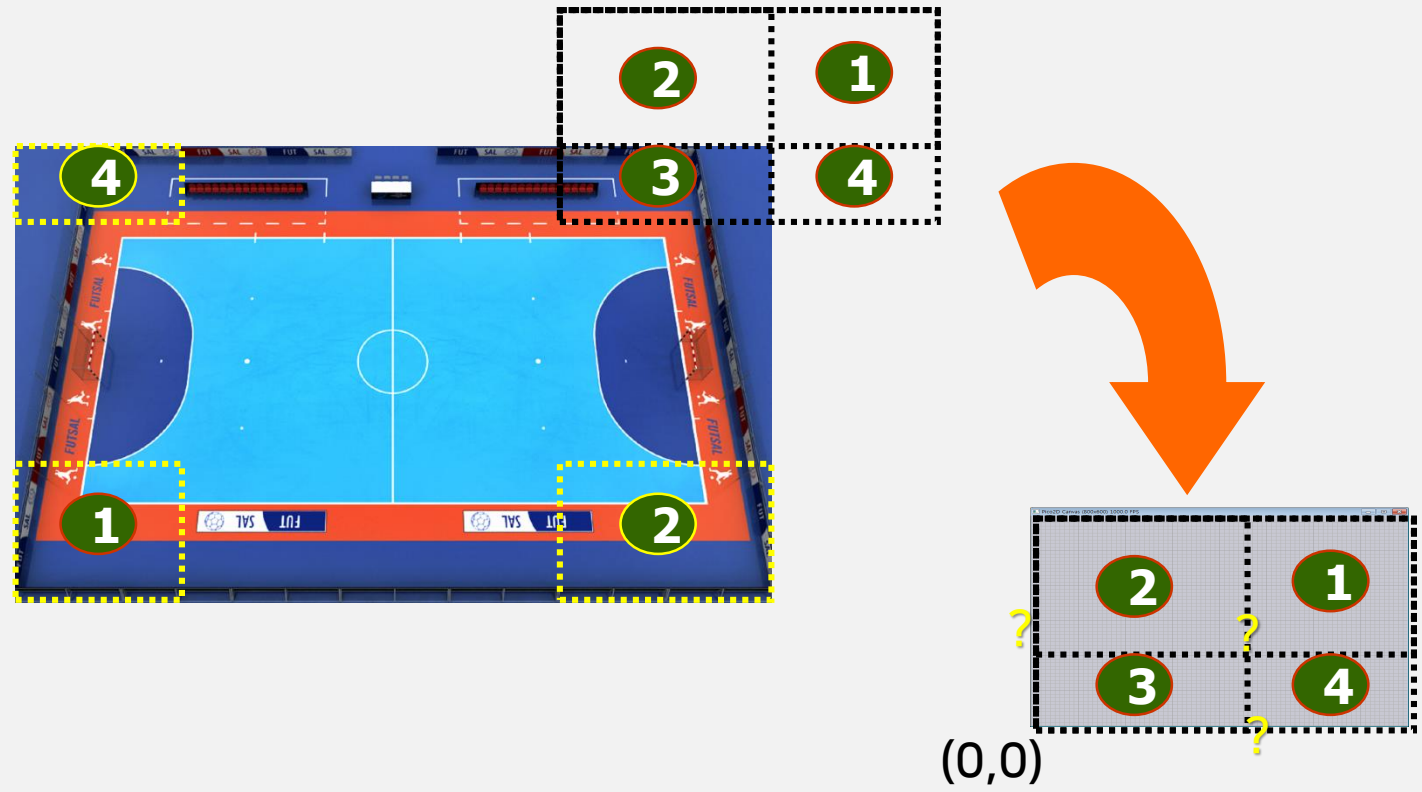
```
def update(self, frame_time):
    #      quadrant 3
    self.q3l = (int(self.center_object.x) - self.canvas_width // 2) % self.w
    self.q3b = (int(self.center_object.y) - self.canvas_height // 2) % self.h
    self.q3w = clamp(0, self.w - self.q3l, self.w)
    self.q3h = clamp(0, self.h - self.q3b, 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 = ?
```

# 상하좌우 무한스크롤링 공식





**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, ?, ?)
```

# 시차(視差) 스크롤링(Parallax Scrolling)

- 물체와 눈의 거리에 따라, 물체의 이동속도가 달라보이는 효과를 이용하여, 3차원 배경을 흉내내는 기법.
- 1982년 “Moon Patrol”이라는 게임에서 세계 최초로 사용됨.

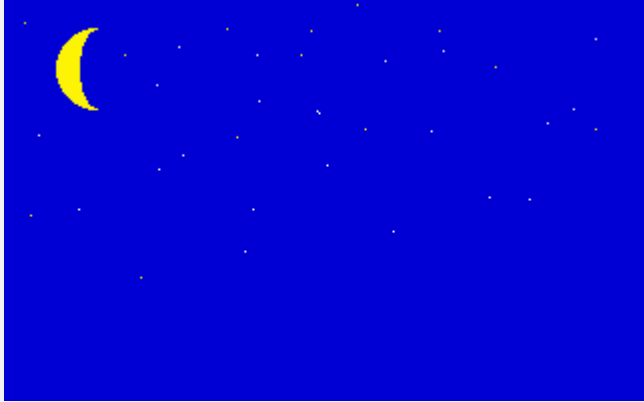


- 밤하늘, 뒷산, 앞산의 스크롤링 속도를 다르게 함으로써, 3차원적인 깊이 효과를 구현.





# 시차 스크롤링 방법



1배속으로 이동



2배속으로 이동



3배속으로 이동



4배속으로 이동

```
def draw(self):
    # fill here
    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(self.center_object.x) - self.canvas_width // 2) % self.w
    self.q3b = (int(self.center_object.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

    # quadrant 4
    self.q4l = 0
    self.q4b = self.q3b
    self.q4w = self.canvas_width - self.q3w
    self.q4h = self.q3h

    # quadrant 1
    self.q1l = 0
    self.q1b = 0
    self.q1w = self.q4w
    self.q1h = self.q2h
```