Multimedia-Programmierung
Übung 6

Ludwig-Maximilians-Universität München
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Today

- Sprites and Pygame

Literature: W. McGugan, Beginning Game Development with Python and Pygame, Apress 2007
Sprites
a.k.a. Spooky things that move but are not really there

• Historically:
  – something that is laid over the background
  – implemented in hardware

• Today:
  – anything that moves over the screen
  – hardware fast enough -> sprites are now software-generated
Sprites in Pygame

• Module `pygame.sprite` provides basic classes and methods to handle sprites
• Class `pygame.sprite.Sprite` used as base class for game objects
• Group Objects are provided as containers/lists for sprites
• Collision detection included
• [http://www.pygame.org/docs/ref/sprite.html](http://www.pygame.org/docs/ref/sprite.html)
The Sprite Class

• Sprite objects **must** contain an image and a location
• **self.image** is a Surface that contains the image information
• **self.rect** is a Rect object that determines the location of the sprite
• A subclass of Sprite should also overwrite the **update()** method
• Contains derived methods that handle the object in groups:
  – **kill()** removes the sprite from all groups
  – **remove(*groups)** removes the sprite from a list of groups
  – **add(*groups)** adds the sprite to groups
  – **groups()** returns a list of groups the sprite belongs to
  – **alive()** tests whether the sprite belongs to any groups
import pygame
from pygame.locals import *

class Box(pygame.sprite.Sprite):
    def __init__(self, color, initial_position):
        pygame.sprite.Sprite.__init__(self)
        self.image = pygame.Surface((20,20))
        self.image.fill(color)
        self.rect = self.image.get_rect()
        self.rect.topleft = initial_position

    def update(self):
        pass

pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)
box = Box((255,0,0),(0,0))
while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((0, 0, 0))
    screen.blit(box.image,box.rect)
    pygame.display.update()
Using the update Method

- Update can hold any number of arguments
- For efficient use of groups, sprites that do the same should have the same arguments

```python
class Box(pygame.sprite.Sprite):
    def __init__(self, color, initial_position):
        pygame.sprite.Sprite.__init__(self)
        self.image = pygame.Surface((20,20))
        self.image.fill(color)
        self.rect = self.image.get_rect()
        self.rect.topleft = initial_position
        self.speed = 300

    def update(self, time_passed):
        moved_distance = time_passed * self.speed
        self.rect.left += moved_distance
```
Using the `update` Method II

```python
import pygame
from pygame.locals import *

# Box Class here

pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

box = Box((255,0,0),(0,0))
clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
        screen.fill((0, 0, 0))
        time_passed = clock.tick() / 1000.0
        box.update(time_passed)
    screen.blit(box.image, box.rect)
    pygame.display.update()
```

Result:

(update the sprite)
Using the update Method - Several Objects

```python
import pygame
from pygame.locals import *
... # Box Class here
pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

box = Box((255,0,0),(0,0))
box2 = Box((0,255,0),(0,60))
box3 = Box((0,0,255),(0,120))
clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((0, 0, 0))
time_passed = clock.tick() / 1000.0
    box.update(time_passed)
    box2.update(time_passed)
    box3.update(time_passed)
    screen.blit(box.image,box.rect)
    screen.blit(box2.image,box2.rect)
    screen.blit(box3.image,box3.rect)
    pygame.display.update()
```

Result:

too cumbersome
Sprite Groups

- Sprite groups (e.g. `pygame.sprite.Group`) are basically lists for sprites
- Handle the cumbersome details for the programmer:
  - `sprites()` returns a list of the sprites in that group
  - `copy()` returns a copy of the group
  - `add(*sprites)` adds a sprite to the list
  - `remove(*sprites)` removes the specified sprites from the list
  - `has(*sprites)` determines whether all sprites are in this group
  - `update(*args)` calls the update method of all sprites in this group (requires that they use the same arguments)
  - `draw(surface)` draws all the sprites in this group to the specified surface (uses `Sprite.image` and `Sprite.rect`)
  - `clear(surface, background)` erases the last drawn sprites from the list
  - `empty()` removes all sprites from the list
import pygame
from pygame.locals import *
...
# Box Class here
pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

boxes = [((255,0,0),(0,0)),((0,255,0),(0,60)),((0,0,255),(0,120))]
sprites = pygame.sprite.Group()
for box in boxes:
    sprites.add(Box(box[0],box[1]))

clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((0, 0, 0))
    time_passed = clock.tick() / 1000.0
    sprites.update(time_passed)
    sprites.draw(screen)
    pygame.display.update()
Advanced Groups (RenderUpdates)

• Drawing the whole screen every time a sprite moves is inefficient
• RenderUpdates helps to avoid this
• Special `draw()` method:
  – `draw(*sprites)` returns a list of Rect objects that define the areas that have been changed
  – Efficient for non-animated backgrounds
Using RenderUpdates

```python
import pygame
from pygame.locals import *

... # Box Class here

pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

boxes = ([(255,0,0),(0,0)],[(0,255,0),(0,60)],[(0,0,255),(0,120)])
sprites = pygame.sprite.RenderUpdates()
for box in boxes:
    sprites.add(Box(box[0],box[1]))
clock = pygame.time.Clock()

background = pygame.surface.Surface((640,480))
background.fill((0,0,0))
screen.blit(background,(0,0))

while True:
    ... QUIT procedure here
    time_passed = clock.tick() / 1000.0
    sprites.update(time_passed)
    rects = sprites.draw(screen)
    pygame.display.update(rects)
    sprites.clear(screen,background)
```

RenderUpdates group

- call draw and store the changed areas
- clear the changes done
Advanced Groups (OrderedUpdates)

• Remembers the order in which sprites are added
• Order is used for drawing the sprites to the screen
• Helps painting objects in the correct order
• Slower to add and remove sprites than other groups
Iterating Sprite Groups

```python
sprites = pygame.sprite.Group()
...
for sprite in sprites:
    print sprite
```
Collision Detection

- **Rect.collidewpoint(point)** can be used to see whether a coordinate is within the area of a Rect object
- **pygame.sprite** has advanced methods to check for collisions
  - E.g. **pygame.sprite.collide_rect(a,b)** checks whether two sprites intersect
A simple collision detection

```
import pygame
from pygame.locals import *

...

pygame.init()

screen = pygame.display.set_mode((640, 480), 0, 32)
box = Box((255,0,0),(0,0))

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
        if event.type == MOUSEBUTTONDOWN:
            if box.rect.collidepoint(event.pos):
                print "in"
            else:
                print "out"
    box.update()
    screen.blit(box.image,box.rect)
    pygame.display.update()
```
Useful Links

- Pygame Sprite Tutorial
  http://kai.vm.bytemark.co.uk/~piman/writing/sprite-tutorial.shtml

- Pygame Documentation !!!!
  http://www.pygame.org/docs