

# Particle System



By Minh Le

## Vector2d

- Similar to Point2d holding multiple attribute of a particle
  - Location
  - Velocity
  - Acceleration

```
public class Vector2d {  
    public double x;  
    public double y;  
}
```

## Particle(1)

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- Particle has multiple attribute

Max size is a cap on particle size

Life control how long particle stay

```
private Vector2d loc;
private Vector2d vel;
private Vector2d acc;
private Vector2d size;
private Vector2d maxSize;
private Vector2d growth;
private Vector2d life;
private Color color;
private BufferedImage image;
private int iter;
private String type;
private String shape;

private ArrayList<String> geo = new ArrayList<String>();

private boolean ultSize = false;
private boolean defaultSize = false;
```



```

public Particle(double x, double y, double dx, double dy, double s
    this.loc = new Vector2d(x,y);
    this.vel = new Vector2d(dx,dy);
    this.acc = new Vector2d(0,0);
    this.life = new Vector2d(life,life);
    this.size = new Vector2d(size,size);
    this.growth = new Vector2d(0,0);
    this.maxSize = new Vector2d(0,0);
    this.type = type;
    this.color = c;
    if (type.equals("image")){
        int randIndex = new Random().nextInt(imageFiles.length);
        try {
            image = ImageIO.read(imageFiles[randIndex]);
        } catch (IOException e) {
            e.printStackTrace();
        }
    }else if (type.equals("animation")){

    }else if (geo.contains(type)){
        this.shape = type;
    }else{
        this.shape = geo.get(new Random().nextInt(geo.size()));
    }
}

```

## Particle (2)

- The constructor will assign attribute for the particle
- Depending on parameter that was pass in the particle will have either geometry shape or picture

## Particle (3)

- Render function will take those variable that was pass into parameter to render the correct particle shape

```
public void render(Graphics g){
    Graphics2D g2d = (Graphics2D) g.create();

    g2d.setColor(color);
    if (type.equals("image")){
        g2d.drawImage(image, (int)(loc.x-(size.x/2)), (int)(loc.y-(size.y/2)), (int)size.x, (int)size.y, null);
    }else if(type.equals("animation")){
        //To-Do Find animation frame and add them here
    }else{
        switch(shape){
            case "oval":
                g2d.fillOval((int)(loc.x-(size.x/2)), (int)(loc.y-(size.y/2)), (int)size.x, (int)size.y);
                break;
            case "smoke":
                g2d.drawOval((int)(loc.x-(size.x/2)), (int)(loc.y-(size.y/2)), (int)size.x, (int)size.y);
                break;
            case "rectangle":
                g2d.drawRect((int)(loc.x-(size.x/2)), (int)(loc.y-(size.y/2)), (int)size.x, (int)size.y);
                break;
            default:
                g2d.fillRect((int)(loc.x-(size.x/2)), (int)(loc.y-(size.y/2)), (int)size.x, (int)size.y);
        }
    }
    g2d.dispose();
}
```

## Particle (4)

- Updating location by adding acceleration to velocity then location
- Default size make sure a particle cannot exceed the cap

```
public boolean update() {
    vel.add(acc);
    loc.add(vel);
    size.add(growth);
    life.x--;

    if(life.x <= 0)
        return true;

    if(defaultSize){
        if(size.x >= maxSize.x){
            if(size.y >= maxSize.y)
                return true;
            else
                size.x = maxSize.x;
        }
        if(size.y >= maxSize.y)
            size.y = maxSize.y;
        if(size.x <= 0)
            if(size.y <= 0)
                return true;
            else
                size.x = 1;
        if(size.y <= 0)
            size.y = 1;
        return false;
    }
}
```

# User interact

- User can spawn 6 particle by clicking into the window. Those particle will take random form.
- User can spawn specific type of particle with keyboard command

```
public void mouseClicked(MouseEvent e) {  
    if (!game_mode){  
        c = new Color(rng.nextFloat(), rng.nextFloat(),rng.nextFloat()); // Random particle color when click  
        addParticle();addParticle();addParticle();  
        addParticle();addParticle();addParticle();  
    }else{  
        for(int i = 0; i <= particles.size() - 1;i++){  
            Particle targetHit = particles.get(i);  
            if (targetHit.getLoc().x == x && targetHit.getLoc().y == y){  
                particles.remove(i);  
            }  
        }  
    }  
}  
  
public void addParticle(){  
    Particle p = new Particle(x,y,0,0,0,0,c, type);  
    p.setVel(random(7),random(7));  
    p.setAcc(random(.02),random(.02));  
    p.setLife(randomPlus(150)+150);  
    p.setSize(randomPlus(25)+25, randomPlus(25)+25);  
    p.setMaxSize(50,50);  
    p.setGrowth(random(2), random(2));  
    p.setUltSize(true);  
    particles.add(p);  
}
```

Thank you for Listening!

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