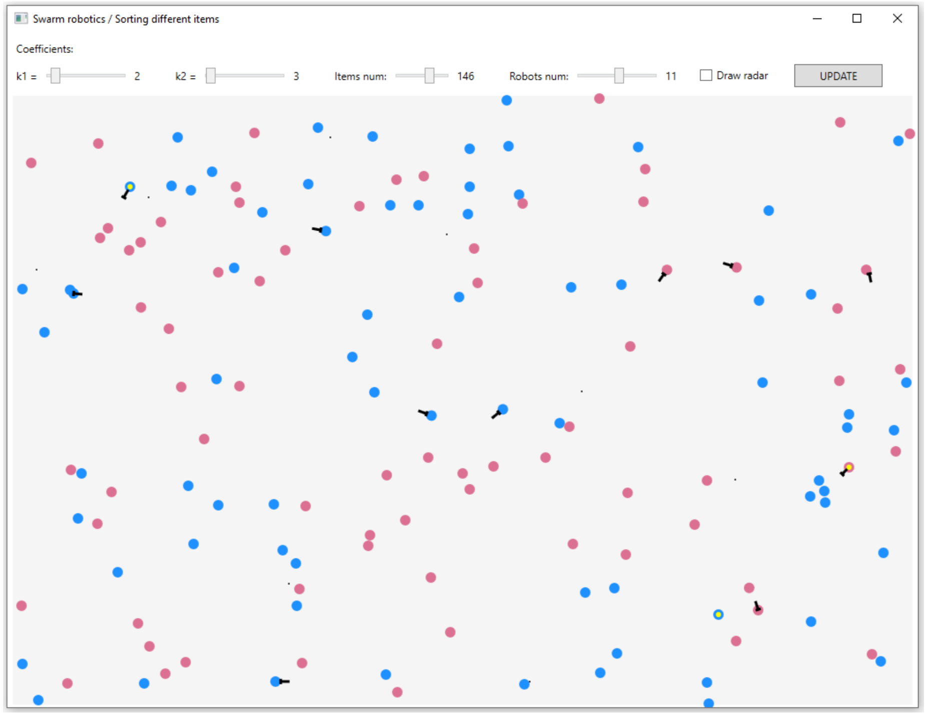
SWARM ROBOTICS

Sorting different objects


Swarm robotics / Sorting different items

Coefficients:

k1 = 2   k2 = 3   Items num: 146   Robots num: 11

Based on N.M.Ershov article "Swarm Robotics Algorithms"

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Robots perform random movements in a given area. Each individual robot can perform the following two actions:

1. **Pick up** the found object;
2. **Drop** the item in the current location if it is free.

These actions are performed by robots in a probabilistic manner based on an analysis of their local neighborhood:

- the robot **picks up** an object it finds with a higher probability, the fewer objects of the same type it sees around it;

- the robot **drops** the object it is carrying with a probability that is greater, the more similar objects it sees around it.

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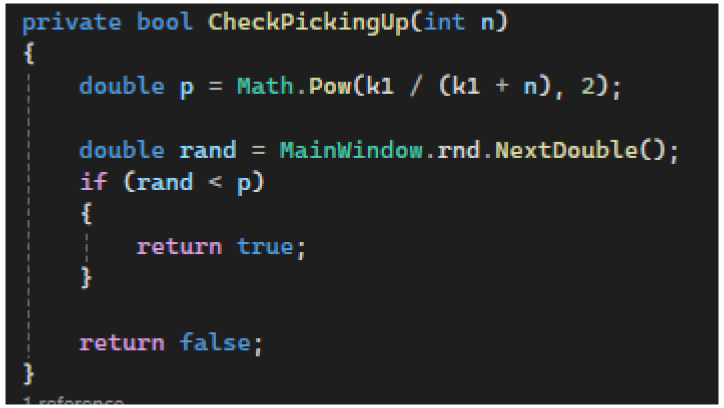
For the simplest case for objects of the same type, the probabilities of lifting **p** and dropping **q** are calculated based on the number **n** of objects located in the field of view of robot:

$$p = \left(\frac{k_1}{k_1 + n}\right)^2 \quad q = \left(\frac{n}{k_2 + n}\right)^2,$$

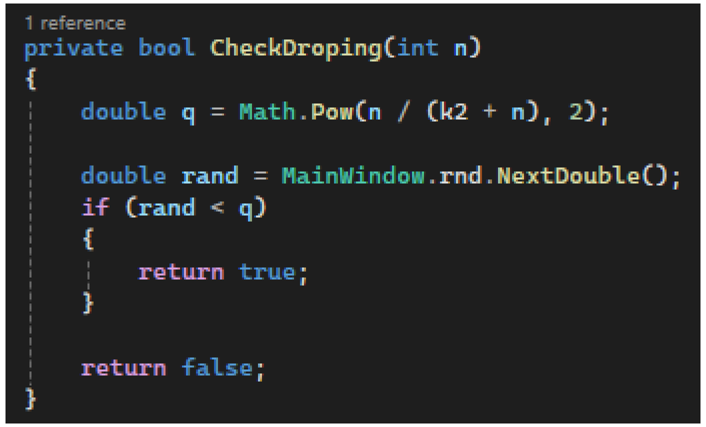
where **k1** > 0 and **k2** > 0 are the control parameters of the algorithm.

$$n = \max(0, n_0 - n_1),$$

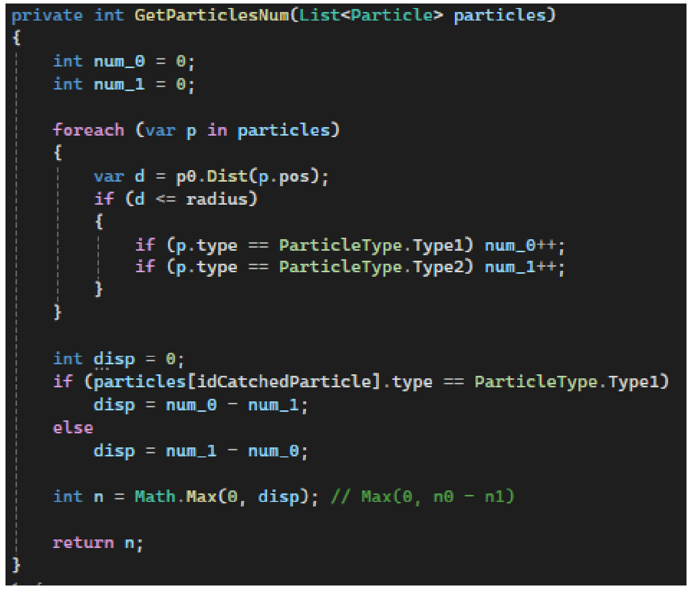
where **n0** is the number of items in the visibility area of the same type as the current item (which the robot wants to take or drop), and **n1** is the number of items of other types.



```
private bool CheckPickingUp(int n)
{
    double p = Math.Pow(k1 / (k1 + n), 2);

    double rand = MainWindow.rnd.NextDouble();
    if (rand < p)
    {
        return true;
    }

    return false;
}
```



```
1 reference
private bool CheckDroping(int n)
{
    double q = Math.Pow(n / (k2 + n), 2);

    double rand = MainWindow.rnd.NextDouble();
    if (rand < q)
    {
        return true;
    }

    return false;
}
```



```
private int GetParticlesNum(List<Particle> particles)
{
    int num_0 = 0;
    int num_1 = 0;

    foreach (var p in particles)
    {
        var d = p0.Dist(p.pos);
        if (d <= radius)
        {
            if (p.type == ParticleType.Type1) num_0++;
            if (p.type == ParticleType.Type2) num_1++;
        }
    }

    int disp = 0;
    if (particles[idCatchedParticle].type == ParticleType.Type1)
        disp = num_0 - num_1;
    else
        disp = num_1 - num_0;

    int n = Math.Max(0, disp); // Max(0, n0 - n1)

    return n;
}
```