With the genetic algorithm model and the three operators above, the layout of the monitor-repeater-EOC system can be obtained.

Figure 4 A sample chromosome

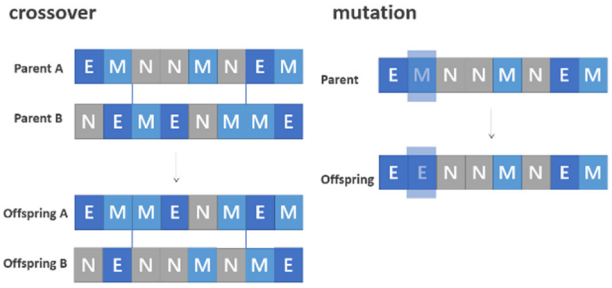

Figure 5 The two operators

2.2.3.The optimization of model

Based on the genetic algorithm, we got the construction method that makes the minimum number of established monitors and EOCs, and at the same time, the signal can cover all the fire-prone points for safety consideration. The distribution of fire-prone points is obtained, as shown in Figure 6.

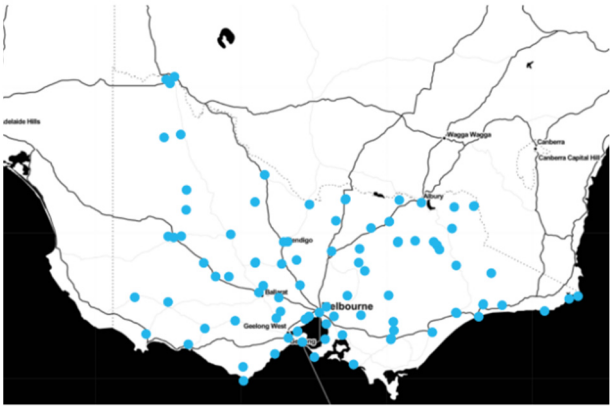

Figure 6 The distribution of fire-prone points

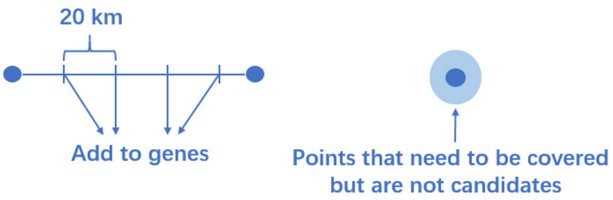

Figure 7 The changes of candidate point set

Considering that the distance between two fire-prone points is usually long, the actual calculation is performed by dividing two points by every 20 km from one of them and adding the dividing point between the two nodes into the candidate point set. It is considered as the gene of the chromosome. It allows the model to be applied in practice with more than the original number of 89 genes.

In addition, we expand the area of a part of the points with high FFDI values, requiring the model to cover a circle of points near the point, but these expanded areas are not among the candidate points (Figure 7).

The above two points are the improvements we made to the model based on the actual situation.

2.2.4.Results

Using the model, we can calculate the latitude and longitude of the EOC and the repeater. The results are visualized, and the final results of the EOC-repeater distribution are shown in Figure 8. Where repeaters are represented using their signal coverage (blue circles), EOC is represented using orange dots, and blue dots indicate possible fire points.

Based on analyzing the results, it can be seen that the system is made up of 47 repeaters and 39 EOCs. The minimum number of drones that the algorithm finds is 256 to respond to possible forest fires timely, without taking into account drone shift change, and the total construction cost of the system is 3,810,000 AUD.

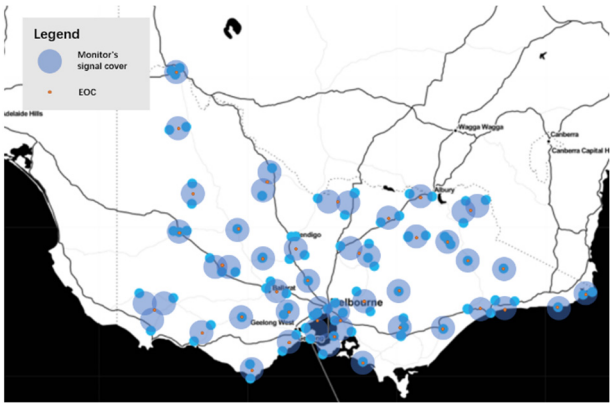

Figure 8 The result of EOC-repeater distribution

3.CONCLUSION

As can be seen from Figure 8, the location selected by the EOC often coincides with the monitor signal cover centroid, which is often on the possible fire point or at the center of several centroids. It is in line with geometry so that the shortest distance between the equipment ensures safety.

In the prediction model, due to the large sample size, there should be better prediction models available for different data, such as the exponential smoothing model and the ARIMA model.

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