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| RESEARCH ARTICLE

Recommendations of Tourism Destinations Using Genetic Algorithm: A Case Study of Cirebon City

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| ABSTRACT
A genetic Algorithm is a search algorithm inspired by natural selection. Genetic algorithms are used in solving optimization problems. Determination of the shortest route in the recommendation of tourism objects has problems in optimization. This study aims to obtain the shortest route from several tourist attractions in Cirebon City, West Java, Indonesia, using a Genetic Algorithm to get the best and optimal route. The search for the shortest route can be completed using a genetic algorithm. The first step is to present the location of the tourist attraction in a sequence code, then form the initial population and then continue in the selection, crossover, and mutation stages until the best route is formed. From the results obtained, the route has the best fitness value of 268 and the best route from 10 attractions, starting with Sunyaragi Cave Park - Kasepuhan Palace - Sang Cipta Rasa Great Mosque - Kanoman Palace - Kacirebonan Palace - Panjunan Red Mosque - At-Taqwa Mosque - Gunung Jati Tomb - Trusmi Batik – Gronggong Hill.

| KEYWORDS

Algoritma Genetika, Wisata, Cirebon

| ARTICLE INFORMATION

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1. Introduction

The city of Cirebon is located in the northern coastal area of West Java Province, Indonesia. This city has the nickname the City of Shrimp. Cirebon City also has many places and types of tourist objects, ranging from cultural tourism, religious tourism, shopping tourism, nature tourism, and other tours. Diverse cultures and many tourist attractions are an attraction for tourists. There are still many tourists who have difficulty visiting tourism in the city of Cirebon because some travel routes have many confusing routes (Napitupulu, 2018). Tourists need effective and efficient travel routes during visits to tourist attractions in Cirebon City to save time and costs. The shortest accessible path is needed because the trip's destination has many paths that can be passed (Suharsono & Saddat, 2018).

A better tourism sector will significantly help the people of Cirebon City. We need a system that can help make it easier for tourists to find tourist routes effectively and efficiently. Based on these problems, several studies regarding the search for the shortest route carried out (Wijanarko et al., 2021) and (Pratama, 2019) in the search for tourist objects in Nganjuk City and Yogyakarta Province using the Genetic Algorithm. Other studies have also searched for the shortest route (Rohman et al., 2020), (Apriani, 2018) in the case of PT. Through genetic algorithms, POS for packet distribution to each agent produces a cost-effective route and reaches every agent.

Further research on finding the shortest route was also carried out by (Santoso & Sanuri, 2019) (Ramadonna et al., 2017), and (Ina et al., 2019).) in the case of product marketing to agents to reach every customer location using genetic algorithms to produce cost-effective routes and reach every home from customers and research to find the shortest route was also carried out (Sanggala, 2020) using genetic algorithms in 20 cities in Russia using Excel calculations generate optimal routes and reach all cities. In this study, the application of genetic algorithms in the search for the shortest route to tourist objects in the city of Cirebon is used in the hope that tourist and efficient travel route optimization will be obtained. Research on genetic algorithms proves that this method can be used effectively in the case of finding the shortest route.

2. Research Methods

2.1 Genetic Algorithm

The Genetic Algorithm is a branch of evolutionary algorithms inspired by Charles Darwin's theory of evolution in solving optimization problems algorithms. This algorithm is inspired by living things that continue to evolve until they are the strongest. The genetic algorithm is to choose the best generation that has undergone an evolutionary process following natural selection, where the strong survive. This algorithm can be used in solving optimization problems. (Wijanarko et al., 2021)

The genetic algorithm has several parameters, and the population is the size of the individuals involved in each generation. The individuals contained in a population are called chromosomes. The initial population stage is selected randomly, and the next stage of the population is the result of the evolution of chromosomes through iterations called generations. In each generation, the chromosomes are evaluated using a fitness function. The fitness value of a chromosome indicates the quality of the chromosomes in the population. (Santoso & Sanuri, 2019)

The next generation is a child (offspring), formed from a combination of two parent chromosomes using a crossover technique. Besides that, a chromosome can also be modified to give birth to new individuals to increase variation through the mutation process, then select the fitness value of the parent chromosome from the value of the parent chromosome. The fitness of the child chromosomes (offspring), as well as eliminating other chromosomes so that the population size becomes constant, after going through several generations, the genetic algorithm will produce a convergent value, or the fitness value of the chromosome does not change in the next generation, which is the best chromosome. (Santoso & Sanuri, 2019)

The fitness value is a value that shows whether or not each individual has achieved the level of suitability of the individual with the criteria or goals (objective) of the problem to be achieved. The genetic algorithm uses this fitness value as a reference in finding the optimal value for individuals. The individual with the best fitness value will be maintained, and those with the lowest will be eliminated.

Crossover is a process of genetic algorithms that combines two parent chromosomes to produce child chromosomes or new individuals who inherit essential characteristics from their parents. Chromosomes that become parents are selected using specific probabilities and are selected randomly.

The mutation creates a new individual by modifying one or more genes in the same individual. A certain probability determines the value of a mutation, and not all chromosomes are mutated. Mutations also serve to replace genes that were lost from the population during the selection process and provide genes that were not present in the initial population. Mutations can increase population variation.

Selection is the process of selecting a new chromosome. Good parents are expected to produce good children. The higher the fitness value of an individual, the more likely it is to be selected, and the lower the fitness value, the more likely it is to be eliminated.

Evaluation is a process to recalculate each chromosome's fitness value in one generation. If the chromosome does not meet the optimal fitness value, the iteration process is carried out to give birth to the generation with the optimal fitness value. (Wijanarko et al., 2021)

3. Research Materials

This study uses a genetic algorithm to determine the shortest route from each tourist destination in the city of Cirebon; the 10 tourist destinations include the At Taqwa Mosque - Gunung Jati Tomb - Kasepuhan Palace - Kanoman Palace - Kacirebonan Palace - Sunyaragi Cave Park - Panjunan Red Mosque - Masjid Agung Sang Cipta Rasa – Trusmi Batik – Gronnggong Hill. This tourist destination is searched for the coordinates using Google maps, which are shown in the table.

Table 1. Tourist Attractions

No	Obyek Wisata	Koordinat	Kode Lokasi
1.	Masjid At-Taqwa (Jl. Kartini No.2, Kebonbaru, Kec. Kejaksan, Kota Cirebon, Jawa Barat 45121)	-6.709936164960578, 108.55863433920344	0
2.	Makam Gunung Jati (Jl. Alun-Alun Ciledug No.53, Astana, Kec. Gunungjati, Kabupaten Cirebon, Jawa Barat 45151)	-6.670969071268031, 108.54014026803924	1
3.	Keraton Kasepuhan (Jl. Kasepuhan No.43, Kesepuhan, Kec. Lemahwungkuk, Kota Cirebon, Jawa Barat 45114)	-6.72613135031499, 108.57107046989191	2
4.	Keraton Kanoman (Jl. Kanoman No.40, Lemahwungkuk, Kec. Lemahwungkuk, Kota Cirebon, Jawa Barat 45111)	-6.722052132625846, 108.56777035269553	3
5.	Keraton Kacirebonan (Jl. Pulasaren, Pulasaren, Kec. Pekalipan, Kota Cirebon, Jawa Barat 45116)	-6.724920664712193, 108.5653237526956	4
6.	Taman Goa Sunyaragi (Sunyaragi, Kec. Kesambi, Kota Cirebon, Jawa Barat 45132)	-6.736523235601858, 108.54311374105579	5
7.	Masjid Merah Panjunan (Jl. Panjunan No.43, Panjunan, Kec. Lemahwungkuk, Kota Cirebon, Jawa Barat 45112)	-6.717356267391858, 108.56608249872771	6
8.	Masjid Agung Sang Cipta Rasa (Jl. Kasepuhan No.Komplek, Kesepuhan, Kec. Lemahwungkuk, Kota Cirebon, Jawa Barat 45114)	-6.725353849991532, 108.56986175269546	7
9.	Batik Trusmi (Jl. Kanoman, Pekalipan, Kec. Pekalipan, Kota Cirebon, Jawa Barat 45117)	-6.69917333236817, 108.50761127742598	8
10.	Bukit Gronggong (Patapan, Kec. Beber, Kabupaten Cirebon, Jawa Barat 45172)	-6.780962273217456, 108.52179032571212	9

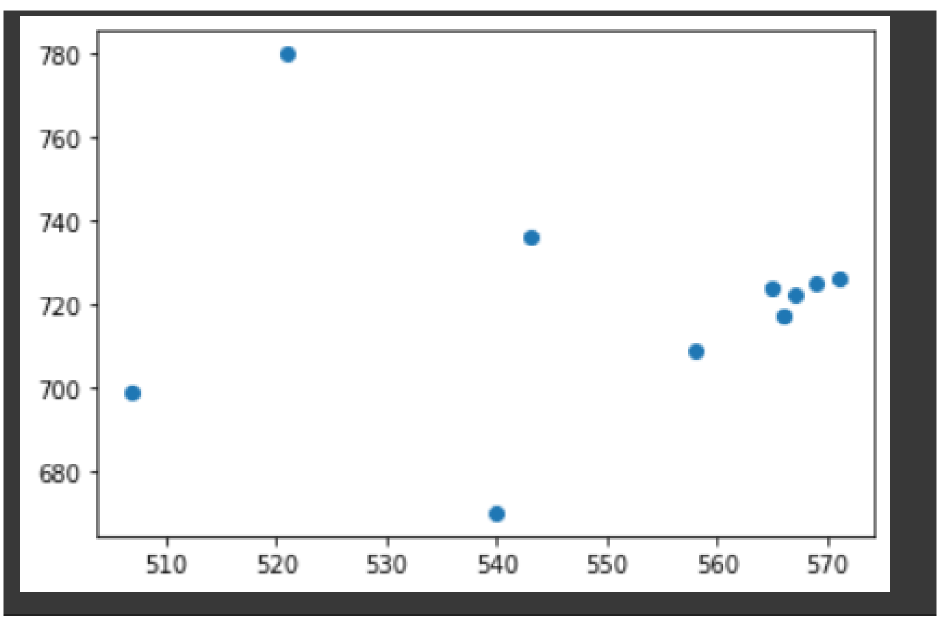

Figure 1. Attraction Coordinates

Each tourist attraction is made a location point based on the coordinates shown in the picture.

The distance matrix of each tourist attraction is calculated using the Euclidean distance formula, and the distance between points is calculated using the formula

$$(x, y) = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

By using this formula, the results of the calculation of the distance between points in the image are obtained.

```
array([[  0,  42,  19,  21,  15,  16,  30,  11,  51,  80],
       [ 42,   0,  62,  64,  58,  59,  66,  53,  43, 111],
       [ 19,  62,   0,   2,   3,   4,  28,   8,  67,  73],
       [ 21,  64,   2,   0,   5,   6,  29,  10,  69,  73],
       [ 15,  58,   3,   5,   0,   2,  27,   5,  64,  74],
       [ 16,  59,   4,   6,   2,   0,  25,   7,  63,  71],
       [ 30,  66,  28,  29,  27,  25,   0,  29,  51,  49],
       [ 11,  53,   8,  10,   5,   7,  29,   0,  61,  77],
       [ 51,  43,  67,  69,  64,  63,  51,  61,   0,  82],
       [ 80, 111,  73,  73,  74,  71,  49,  77,  82,   0]])
```

Figure 2. Distance of each tourist attraction

1. Diagram Alir

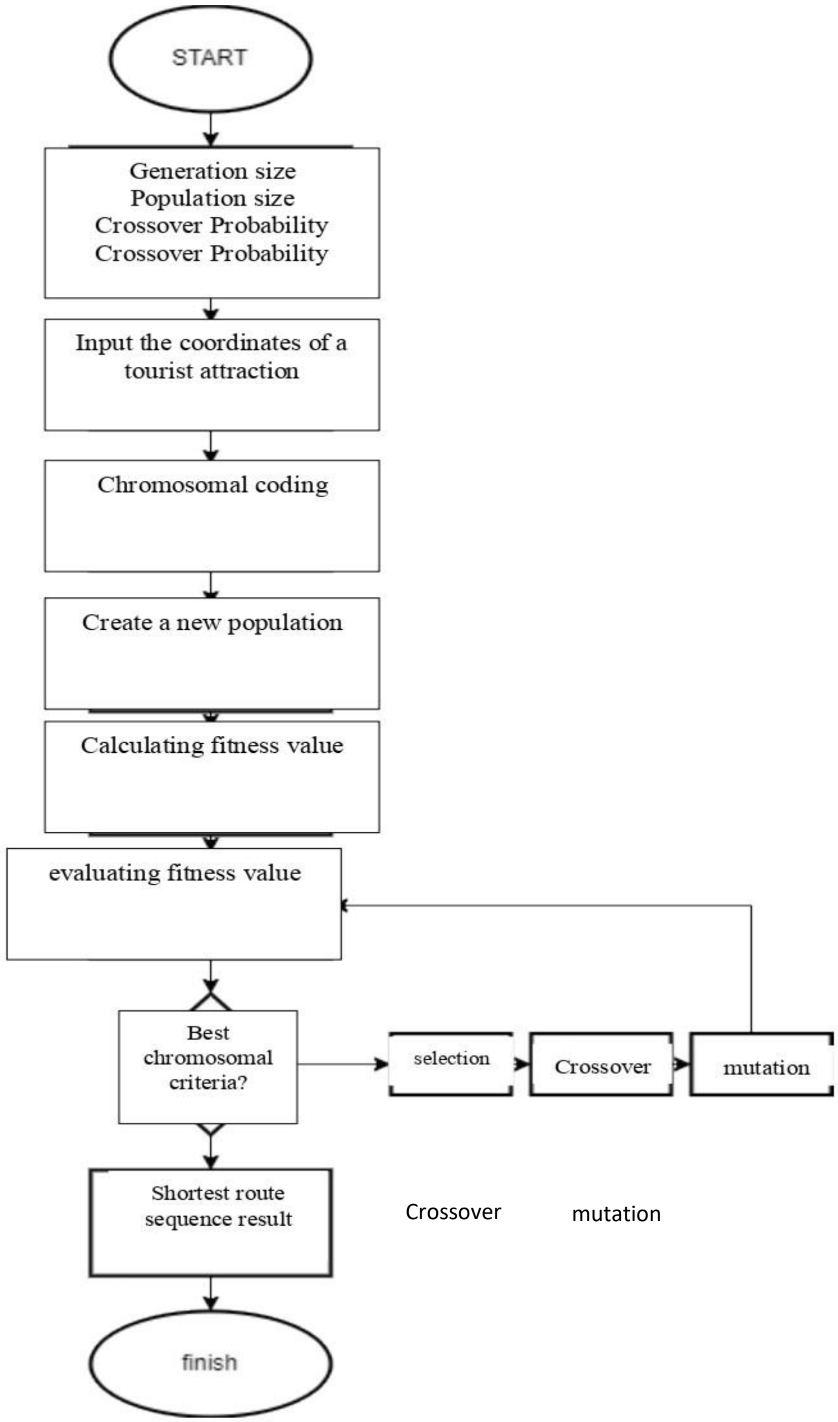

Figure 3. Flowchart

Needed in the calculation of the genetic algorithm include population size = 10, crossover probability = 1, mutation probability = 1, maximum generation = 50, and chromosome length = 10.

4. Results and Discussion

This study applies a genetic algorithm to recommend tourist destinations in the city of Cirebon, which is to determine the best route with the shortest distance. Each tourist attraction that will be passed by tourists is measured by distance; the number of tourist destinations used in the study is 10 destinations in the city of Cirebon, namely At Taqwa Mosque - Gunung Jati Tomb -

Kasepuhan Palace - Kanoman Palace - Kacirebonan Palace - Sunyaragi Cave Park - Panjunan Red Mosque - Sang Cipta Rasa Great Mosque – Trusmi Batik – Gronnggong Hill, population size is 10, crossover probability is 1, mutation probability is 1, and maximum generation is 50 using Python programming language.

Completion using a genetic algorithm through the stages of generating an initial population of 10 populations with 10 chromosomes containing the code of a tourist attraction of 10 experiments, from each departure of a tourist attraction using the genetic algorithm, the best fitness value results are shown in the table.

Table 2. Test Results

No	Jalur	Nilai *Fitness*	Konvergen di generasi ke
1	5 2 7 3 4 6 0 1 8 9	268	31
2	4 7 0 1 8 9 6 5 2 3	269	31
3	1 8 9 6 5 3 2 4 7 0	269	31
4	2 3 5 6 9 8 1 0 7 4	269	31
5	3 2 5 6 9 8 1 0 7 4	269	31
6	7 0 1 8 9 6 5 2 3 4	269	31
7	9 7 4 2 6 3 5 0 1 8	271	24
8	6 0 1 8 9 5 7 2 3 4	271	24
9	8 9 6 5 2 3 4 7 0 1	272	24
10	0 1 8 9 6 5 4 2 3 7	272	34

From the test results table, it can be seen that the difference in the fitness value and the best path length from the initial positions of the tourist attraction route, the best fitness value is obtained on the departure route 5 with a fitness value of 268 then paths 4, 1, 2, 3 7 with a fitness value of 269, lane 9, 6 and the fitness value is 271, and the path is 8.0 with a fitness value of 272. The best route obtained is 5 2 7 3 4 6 0 1 8 9 or Taman Goa Sunyaragi – Kasepuhan Palace – Sang Cipta Rasa Great Mosque – Kanoman Palace – Kacirebonan Palace - Panjunan Red Mosque - At-Taqwa Mosque - Gunung Jati Tomb - Trusmi Batik - Gronggong Hill.

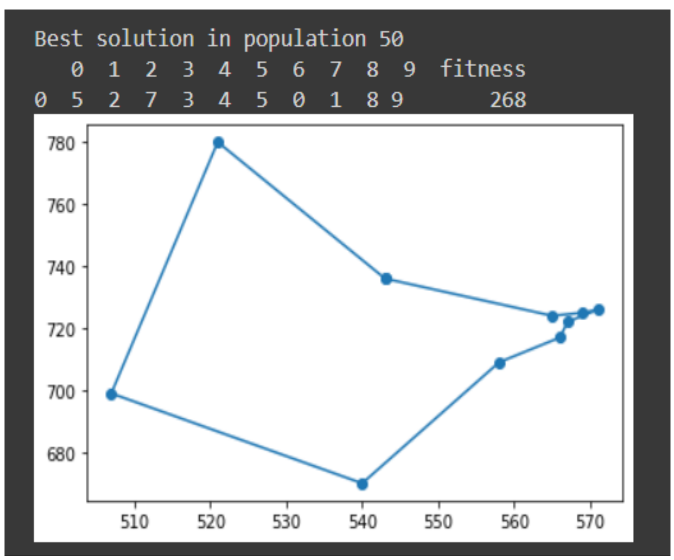

Figure 4. Shortest Route Search Results

The picture with the departure from Sunyaragi Cave Park results in a path that moves forward around each destination without turning around or crossing. Based on the research results, the best path length and the best fitness achievement resulted in a value of 268 with a departure from Sunyaragi Cave Park. The genetic algorithm looks for the best population based on the fitness value. This method chooses the closest route that is produced. Not continuously varies in the same sequence even though it has the same fitness value. The tourist route at the Keraton location has close distances completed not sequentially and produces a route according to the departure point. These results prove that genetic algorithms can be used to find the closest route.

5. Conclusion

A genetic Algorithm is a search algorithm inspired by natural selection. Genetic algorithms are used in solving optimization problems. Determination of the shortest route in the recommendation of tourism objects has problems in optimization. This study aims to obtain the shortest route from several tourist attractions in Cirebon City, West Java, Indonesia, using a Genetic Algorithm to get the best and optimal route. This study concludes that the shortest route obtained in the problem of finding tourist destinations from 10 locations in Cirebon City using a genetic algorithm produces the shortest route based on the best fitness value of 268, namely Taman Goa Sunyaragi - Kasepuhan Palace - Sang Cipta Rasa Great Mosque - Kanoman Palace - Kacirebonan Palace. - Panjunan Red Mosque - At-Taqwa Mosque - Gunung Jati Tomb - Trusmi Batik - Gronggong Hill. This research also produces suggestions that are expected to be useful for further studies. Namely, research only produces the shortest route but does not display other indicators such as travel time, road terrain, and congestion load. The program can follow the user's wishes if a desire is needed to start a certain route and the need for comparison with other algorithms to find the shortest route.

References

[1] Apriani, N. P. (2018). *Penyelesaian Travelling Salesman Problem (TSP) menggunakan Ant Colony Optimization (ACO) dan Algoritma Genetika: Studi Kasus PT. POS Indonesia Katapang*. UIN Sunan Gunung Djati Bandung.

[2] Ina, W. T., Manu, S. O., & Matahhine, T. Y. (2019). Penerapan Algoritma Genetika pada Travelling Salesman Problem (Tsp)(Studi Kasus: Pedagang Perabot Keliling di Kota Kupang). *Media Elektro Journal*, 48–53.

[3] Napitupulu, C. (2018). *Implementasi Algoritma Genetika untuk Penyelesaian Travelling Salesman Problem (TSP) Berbasis Android*.

[4] Pratama, D. (2019). *OPTIMASI PENYELESAIAN TRAVELING SALESMAN PROBLEM WITH TIME WINDOWS (TSP-TW) PADA RUTE OBYEK WISATA DI PROVINSI DI YOGYAKARTA MENGGUNAKAN ALGORITMA GENETIKA BERBASIS ANDROID*. UPN Veteran Yogyakarta.

[5] Ramadonna, T. F., Silvia, A., & Ciksadan, C. (2017). Perbandingan Algoritma Genetika dan TSP Untuk Optimalisasi Jaringan Akses Fiber To The Home. *Jurnal Teknik Informatika Dan Sistem Informasi*, *3*(2), 141119.

[6] Rohman, S., Zakaria, L., Asmiati, A., & Nuryaman, A. (2020). Optimisasi travelling salesman problem dengan algoritma genetika pada kasus pendistribusian barang pt. pos indonesia di kota bandar lampung. *Jurnal Matematika Integratif*, *16*(1), 61–73.

[7] Sanggala, E. (2020). Pengembangan Aplikasi Algoritma Genetika Berbasis Vba Excel Untuk Menyelesaikan Travelling Salesman Problem (Contoh Kasus: Tsp 20 Kota Di Rusia). *Media Jurnal Informatika*, *12*(1), 5–11.

[8] Santoso, H., & Sanuri, R. (2019). Implementasi Algoritma Genetika dan Google Maps API Dalam Penyelesaian Traveling Salesman Problem with Time Window (TSP-TW) Pada Penjadwalan Rute Perjalanan Divisi Pemasaran STMIK El Rahma. *Teknika*, *8*(2), 110–118.

[9] Suharsono, T. N., & Saddat, M. R. (2018). Penentuan Optimalisasi TSP (Travelling Salesman Problem) Distribusi Barang Menggunakan Algoritma Genetika Di Buka Mata Adv. *Prosiding-Seminar Nasional Teknik Elektro UIN Sunan Gunung Djati Bandung*, 326–335.

[10] Wijanarko, A., Amalia, E. L., & Yunianto, D. R. (2021). Pencarian Rute Terpendek Dengan Pendekatan TSP Menggunakan Metode Algoritma Genetika Studi Kasus Kabupaten Nganjuk. *Seminar Informatika Aplikatif Polinema*, 100–105.