Comparison Analysis of Bubble Sort and Insertion Sort Algorithm on The Selection of a Shop According to The Criteria

Deandy Zahran Vierdansyah[1], Ghalbin Al Ghafiqi[1], Muhammad Taufik Dwi Putra[1] , Deden Pradeka[1]

[1]Universitas Pendidikan Indonesia, Bandung, Indonesia

ARTICLE INFO	ABSTRACT
	In choosing a place to open a business was very important and must be considered. One of the suitable places to open a business was a kiosk. This study aimed to facilitate the public in determining the location of the sales kiosk. This was motivated by the limitations and speed in accessing information about the location of the kiosk. In this study, there was a process system for comparing execution time analysis using the Bubble Sort and Insertion Sort algorithms based on the criteria that had been provided. There were criteria that could be selected by users, including the location of the sales kiosk, the area and the available kiosk rental price per year. So that this research system could overcome community problems in terms of limitations and the speed of accessing information that was less efficient about the location of the sales kiosk. After the implementation and analysis of execution time on sales kiosk data as many as 10 places in the C++ programming language using Codeblocks, the results obtained were the use of the Insertion Short algorithm, the use of the Insertion Sort algorithm was more effective in sorting the kiosk places according to the criteria provided.

Deandy Zahran Vierdansyah,
Universitas Pendidikan Indonesia, Bandung, Indonesia
Email: deandy@upi.edu

1. INTRODUCTION

For people who are wanting to open a business by looking for a previous place, this is the start of running their business. The choice of business location is a factor that must be considered. One of the suitable places to be used as a place of business is a kiosk. Kiosk is a small shop that was built as a place of business for people who want to start a business. Usually, kiosks are used to sell a variety of goods. Besides being used to sell goods, the kiosk can also be used as a place to eat, for example a café.

The density of the population is increasing, especially in urban areas, so it is not easy to find a place of business for people who want to start a business. There are several problems encountered when looking for a place of business that suits your taste, this causes limitations and inefficient time in finding information about the place of business you want to use for business.

Technological developments are now developing very rapidly, the use of information and communication technology in finding information about places of business, especially sales kiosks, is easy to do. So that it can be used as a solution to solve the problems that occur. The design system for the utilization of information and communication technology is designed using a process of comparing execution times in sorting information regarding the criteria that have been provided starting from the smallest to the largest. The available criteria include the location of the kiosk, the size and price of the kiosk rental per year, so that it can provide an overview for people who are looking for a selling kiosk.

Completeness of information is the most important part of a system, because it will make it easier for users to use. To be able to obtain better and faster data access, it is expected that data processing will also be better. Sequencing data plays an important role which is considered by many so that problems especially

regarding processing will be better and faster to solve [1]. There are various solving procedures for solving data sorting problems or it can be called a sorting algorithm.

The designed technology and information can provide an overview of society in general, and to the kiosk seeker. The system is designed using the process of searching and selecting the appropriate kiosk by showing the latest, detailed and complete information on prices, facilities, and location. In determining the place of business this factor is the most important factor because it can adjust the finances that we have. Especially in this day and age, it's hard to find a place of business that is cheap and has facilities according to what we want, right.

Therefore, here we are designing a system which will later bring up kiosks with rental prices and an area according to the wishes of people who want to start a business. By utilizing this system, it will make it easier for people who want to choose a kiosk according to the criteria that have been provided. And later it will display kiosks with rental prices and area from smallest to largest.

The process of searching for data can be optimized if it is stored in a sequential way, which is the importance of sorting. One important aspect of optimizing the speed of the sorting process is the level of efficiency. If the algorithm has high efficiency, then the process will make a faster time and can process more detailed data. There are several factors that are considered in deciding the community to choose the location of the kiosk. The aspects that most determine the location of the kiosk are the perception of the rental price, public facilities, and location.

In this research, there is a process analysis system for comparing the execution time of the sorting algorithm, namely using the Bubble Sort and Insertion Sort algorithms in the C++ programming language using CodeBlocks Software [2]. This study aims to determine the sorting algorithm that has a faster level of execution time efficiency of sorting data. So that it can build a decision support system for selecting kiosks in the community so that it becomes a solution in finding sales stalls quickly and efficiently.

The purpose of this research is to build a decision support system for choosing a kiosk. Where later will compare the 2 algorithms based on execution time. The sorting algorithm that has the highest efficiency will result in a faster execution time. The results will later prove which algorithm is more efficient in finding kiosk data in the Jakarta area. Maybe this system can be useful for people who want to start a business and can also help people find kiosks according to the criteria they want.

2. METHOD

In this study, it was carried out using prepared data with a total of 10 sales kiosks and grouped in which there were 3 criteria including area, kiosk rental price per year, and kiosk location. This study uses a sorting algorithm comparison system, namely bubble sort and insertion sort which are implemented in the C++ programming language.

2.1. Research Stages

The following are the stages carried out in this research, overview diagram are shown in **Fig. 1**.:
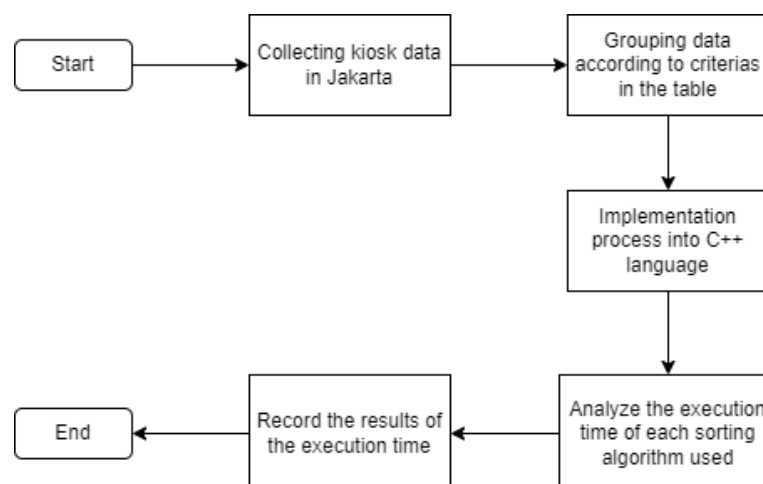

Fig. 1. Research Stages

a. Data Collection

In this process, we are collecting data from research results using the Google engine which originates from a website that provides kiosk rentals, namely https://www.99.co/id/sewa/kiosk. From the results of collecting search data for kiosks in Jakarta, there were 10 sales kiosk data, shown in **Table 1.**

Table 1. Kiosk Data in Jakarta

No.	Kiosk Name	Area (m^2)	Rent Cost/Year (Rp.)	Location
1.	Kios Gading Nias	2	18.000.000	North Jakarta
2.	Kios PGC	5	3.900.000	East Jakarta
3.	Kios Palmerah	24	55.000.000	West Jakarta
4.	Kios Pondok Labu Cilandak	30	40.000.000	South Jakarta
5.	Kios Tanah Abang Blok B	4	25.000.000	Central Jakarta
6.	Kios Pasar Laris	6	15.000.000	West Jakarta
7.	Kios Kelapa Gading	8	30.000.000	North Jakarta
8.	Kios Pasar Senen	12	50.000.000	Central Jakarta
9.	Kios Ujung Menteng	36	1.800.000	East Jakarta
10.	Kios Kemang Timur	32	70.000.000	South Jakarta

b. Data Processing

After the data has been collected. The next process is to process the data into data tables which are then grouped according to predetermined criteria, namely the name of the kiosk, the area of the kiosk building, the kiosk rent price per year and the location of the kiosk located (Table 1 Kiosk Data in Jakarta) [3].

c. Implementation to C++ programming language

The implementation process into the C++ programming language uses the CodeBlocks software [10]. The implementation process compares 10 kiosk data with the criteria of annual rental prices and the building area of the kiosk that has been made. The table will be compared with the execution time of the Bubble Sorting and Insertion Sort algorithms using the codeblocks software command into the implementation of the C++ language as follows:

1) Insertion Sort (Kiosk Building Area)

On the first menu in the programming that has been made is the command used to sort the smallest to largest values in the kiosk building area data using the Insertion Sort algorithm:

```
void insertionLuas(kios arr[], int n)
{
    int j;
    kios key;
    for(int i = 1; i<n; i++) {
        key = arr[i];
        j = i;
        while(j > 0 && arr[j-1].luas>key.luas) {
            arr[j] = arr[j-1];
            j--;
        }
        arr[j] = key;
        for(int k = 0; k<n; k++){
            cout << arr[k].luas << " ";
         }
         cout << endl;
    }
}
```

2) Insertion Sort (Kiosk Rental Cost Per Year)

Furthermore, on the second menu in the programming that has been made is the command used to sort the smallest to largest values in the kiosk rental cost data per year:

```
void insertionHarga(kios arr[], int n)
{
    int j;
    kios key;
    for(int i = 1; i<n; i++) {
        key = arr[i];
        j = i;
        while(j > 0 && arr[j-1].harga>key.harga) {
            arr[j] = arr[j-1];
            j--;
        }
        arr[j] = key;
        for(int k = 0; k<n; k++){
            cout << arr[k].harga << " ";
         }
         cout << endl;
    }
}
```

3) Bubble Sort (Kiosk Building Area)

On the third menu in the programming that has been made is the command used to sort the smallest to largest values in the data for the area of the next kiosk building using the Bubble Sort algorithm:

```
void bubbleLuas(kios arr[], int n)
{
    int i, j;
    bool swapped;
    for (i = 0; i < n-1; i++)
    {
      swapped = false;
      for (j = 0; j < n-i-1; j++)
      {
         if (arr[j].luas > arr[j+1].luas)
         {
            swap(&arr[j], &arr[j+1]);
            swapped = true;
         }
         for(int k = 0; k<n; k++){
              cout << arr[k].luas << " ";
          }
          cout << endl;
      }
      if (swapped == false)
         break;
    }
}
```

4) Bubble Sort (Kiosk Rental Cost Per Year)

Furthermore, on the fourth menu in the programming that has been made is the command used to sort the smallest to largest values in the kiosk rental price data per year:

```
void bubbleHarga(kios arr[], int n)
{
    int i, j;
    bool swapped;
    for (i = 0; i < n-1; i++)
    {
      swapped = false;
      for (j = 0; j < n-i-1; j++)
      {
         if (arr[j].harga > arr[j+1].harga)
         {
            swap(&arr[j], &arr[j+1]);
            swapped = true;
         }
         for(int k = 0; k<n; k++){
              cout << arr[k].harga << " ";
          }
          cout << endl;
      }

      if (swapped == false)
         break;
    }
     }
```

d. Result Analysis

Analyse the execution time of the two sorting algorithms. The analysis process is obtained from the results of the execution time data of the insertion sort and bubble sort algorithms which are calculated using units of seconds based on 10 sales kiosk data in Jakarta which have been grouped based on predetermined criteria.

3. RESULTS AND DISCUSSION

After analyzing the execution time of the insertion sort and bubble sort algorithms, record the execution results of the two sorting algorithms. In a comparison of the execution time results of Insertion sort and Bubble Sort on the area of the kiosk building, the results are obtained.

In the criteria for the area of the kiosk building (**Fig. 2.** and **Fig. 3**.) the results of implementation into the C++ programming language using CodeBlock Software show the sorting steps for the area of the kiosk building based on the sorting method of the two sorting algorithms. Figure 2 shows the 9 process steps for sorting data in the Insertion Sort algorithm for the area of the kiosk building. Furthermore, Figure 4 shows the 42 process steps for sorting data in the Bubble Sort algorithm for the area of the kiosk building. This shows that the comparison of the data sorting process is longer than Bubble Sort than Insertion Sort.

Fig. 2. Process Steps for Ordering Insertion Sort Kiosk Building Area

Fig 3. Result of Execution Time of Insertion Sort Kiosk Building Area

Fig 4. Bubble Sort Sequencing Process Kiosk Building Area

Fig 5. Results of Bubble Sort Execution Time Kiosk Building Area

After the data on the building area of the kiosk has been sorted based on the sorting steps of the Insertion Sort and Bubble Sort algorithms. The results show that the Gading Nias Kiosk in North Jakarta is smaller with an area of 2 m2 and the Ujung Menteng Kiosk in East Jakarta is larger with an area of 36 m2.

Then in **Fig. 2.** and **Fig. 4.** show the results of the execution time of each of the two sorting algorithms. Furthermore, the results of the execution time are recorded on the area of the kiosk building from the two sorting algorithms (**Table 2**).

In Insertion Sort, the results of the execution time were recorded as 64,469 s, while Bubble Sort was 82,3274 s, this shows that the execution time of the Insertion Sort algorithm in sorting data on the size of the kiosk building is faster than Bubble Sort.

In the criteria for kiosk rental prices per year (**Fig. 6.** and Fig. 8.) the results of implementation into the C++ programming language using CodeBlock Software show the steps for sorting kiosk rental prices per year based on the sorting method of the two sorting algorithms. **Fig. 6.** shows the 9 process steps for sorting data in the Insertion Sort algorithm for the area of the kiosk building. Furthermore, **Fig. 4** and **Fig. 5.** shows the 45 process steps for sorting data in the Bubble Sort algorithm at the kiosk rental price per year. This shows that the comparison of the data sorting process is longer than Bubble Sort than Insertion Sort.

After the data on the kiosk rental price per year has been sorted based on the sorting steps of the Insertion Sort and Bubble Sort algorithms. The results show that the Ujung Menteng Kiosk in South Jakarta is smaller, with an annual rental price of 1,800,000 and the East Kemang Kiosk in South Jakarta is larger, with a price of 70,000,000.

Table 2. Execution Time Result Kiosk Building Area

Execution Time (s)	
Insertion sort	Bubble sort
64.469	82.3274

Fig 6. Insertion Sort Sequence Process Kiosk Rental Cos Per Year

Fig 7. Result of Execution Time of Insertion Sort Kiosk Rental Cost Per Year

Fig 8. Bubble Sort Sequencing Process Kiosk Rental Cost Per Year

Fig 9. Results of Bubble Sort Execution Time Kiosk Rental Cost Per Year

Table 3. Results of Execution Time Kiosk Rental Cost Per Year

Waktu Eksekusi (s)	
Insertion sort	Bubble sort
55.019 s	67.465 s

After the data on the building area of the kiosk has been sorted based on the sorting steps of the Insertion Sort and Bubble Sort algorithms. Then in Figures 7 and 9 show the results of the execution time of each of the two sorting algorithms. Furthermore, the results of the execution time are recorded at the kiosk rental prices per year from the two sorting algorithms (Table 3).

In Insertion Sort, the results of the execution time were recorded as 55,019 s, while Bubble Sort was 67,465 s. This shows that the execution time of the Insertion Sort algorithm in sorting data on the size of the kiosk building is faster than Bubble Sort.

Based on the results of the data kiosk that has been implemented in the C++ programming language above, it can be seen that the insertion sort algorithm is faster and more effective than the bubble sort algorithm in sorting data. The time difference is quite a lot, around 10-15 seconds. It can also be seen that the results of bubble sort are longer than insertion sort.

4. CONCLUSION

After conducting an experiment by collecting 10 kiosk data with the criteria of area, price, and location, it can be seen from the criteria for the area of the Ujung Menteng kiosk being the largest kiosk with an area of 36 m2 and the Gading Nias kiosk being the smallest kiosk with an area of 2 m2, on the price criteria for Kemang kiosks Timur is the most expensive stall with a price of 70 million per year and the Ujung Menteng kiosk is the cheapest stall with a price of 1.8 million per year. In the comparison of execution time it can be concluded that the insertion sort algorithm is faster than the bubble sort algorithm. The insertion sort algorithm's sorting is also less, whereas in bubble sort the sorting is quite long. Based on this research, it can be seen which algorithm is more efficient in execution time and it can also be seen which sequence is less. And the execution results are quite fast and can work well. Maybe in the future it will provide other features such as adding distance to kiosks, facilities, location placement, and images and others. By adding this feature, it will make it easier for the public to choose a kiosk according to their wishes, criteria, needs and convenience of a kiosk for those who want to start their business. Hopefully the system that has been created can be useful for people who want to start a business and are looking for kiosks with criteria that match what they want.

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