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Nearby Search Indekos Based Android Using A Star (A*) Algorithm

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Abstract. Indekos or rented room is a temporary residence for months or years. Society of academicians who come from out of town need a temporary residence, such as Indekos or rented room during their education, teaching, or duties. They are often found difficulty in finding a Indekos because lack of information about the Indekos. Besides, new society of academicians don’t recognize the areas around the campus and desire the shortest path from Indekos to get to the campus. The problem can be solved by implementing A Star (A*) algorithm. This algorithm is one of the shortest path algorithm to a finding shortest path from campus to the Indekos application, where the faculties in the campus as the starting point of the finding. Determination of the starting point used in this study aims to allow students to determine the starting point in finding the Indekos. The mobile based application facilitates the finding anytime and anywhere. Based on the experimental results, A* algorithm can find the shortest path with 86,67% accuracy.

1. Introduction
Society of academicians who come from out of town need a temporary residence, such as Indekos or rented room during their education, teaching, or duties. They are often found difficulty in finding a Indekos because lack of information about the Indekos. Besides, new society of academicians don’t recognize the areas around the campus and desire the shortest path from Indekos to get to the campus. The need of such information can be served if there is a place, system, or an application for collecting and broadcasting information about the place of the Indekos. Due to that case, the finding of Indekos can be done using Android smartphone with GPS and Google Maps. Then, to find the nearest Indekos can be done by using A Star algorithm. A Star algorithm is a best-first search that uses cost function. The cost function is used to count distance, area, or another factor to decide either a route is selected or not. The cost function checks the feasibility of the cost required to reach a node from another node [1]. In this study, the authors create an application using A Star algorithm. A Star algorithm is a best-first search that uses cost function. The cost function is used to count distance, area, or another factor to decide either a route is selected or not. The cost function checks the feasibility of the cost required to reach a node from another node [1].

In this study, the authors create an application using A Star. Google Maps is used in this application to determine the coordinate point. The finding of Indekos using each faculty as the starting point. To get the shortest path, the application uses heuristic function and A Star algorithm to find the nearest path. In addition, traffic congestion is set as one of the parameter to find the shortest path in this application of study. This journal is structed by the following sections: Section II describes the problem identification in this study. Section III describes some previous researches that have been done. Section IV describes how the application in this study is developed by the proposed method. The results of the study are discussed in Section V. Section VI contains research conclusions, as well as suggestions for further research.
2. Problem Identification
Students are often found difficulty in finding a Indekos because they don’t recognize the areas around the campus very well. Moreover, the information of Indekos often less actual so students do not have any standards to find a Indekos. The finding shortest path to the Indekos based on Android application is expected to solve this problem.

3. Previous Research
Several previous researches have been conducted to solve the problem of finding the shortest path in some cases. Research conducted in 2011 by Tilawah applies A Star (A*) algorithm to solve maze problem. He found that A* algorithm can be applied to solve the maze problem by storing data the position of the maze wall as a non-walkable node [2]. Research conducted by Hannawati, Thiang, and Eleazhar is to find the shortest path using Genetic algorithm. They found that genetic algorithm is quite effective and easy to use, especially in terms of finding the shortest path and the shortest time based on path conditions [3]. Research conducted in 2015 by Hutabarat is to find the shortest path using the Floyd-Warshall algorithm in online taxi application. The shortest path is found by making points of intersection in the protocol streets in Medan city. He found that the Floyd-Warshall algorithm can calculate the distance of the nearest taxi from the client [4]. Research conducted in 2016 by Siregar is to find the shortest path of food delivery. He applies A Star algorithm and uses Geographical Information System (GIS) for vehicle usability. By applying A Star algorithm to find the shortest path, the food delivery system works well. However, it should also consider traffic congestion in finding the shortest path [5].

4. Methodology
The method proposed in finding the shortest path to get the nearest Indekos information is by using A Star algorithm.

4.1. General Architecture
The application is developed to find the nearest Indekos. Users of this application are society of academicians who need a temporary residence, such as Indekos or rented room. The general architecture of the system can be seen in Figure 1.

![General Architecture](image)

**Figure 1.** General Architecture
The data used in this application is data of Indekos, rented room, faculty, traffic congestion point, coordinate point, and relation point. An administrator inputs the data into the database so the data can be used to find the shortest path to the Indekos from the faculty. Users (society of academicians) who want to find Indekos can choose a faculty marked in the map. After that, the user can choose to find either Indekos or rented room. The system will look for the nearest Indekos or rented room from the faculty chosen by the user. Determination of the location of the nearest Indekos or rented room is done
by using the Euclidean Distance heuristic function. Then, the system will look for the shortest path using the A Star algorithm according to the path weight due to some traffic congestion points that may exist on the path. As the output, the map will show the shortest path that has been processed by the system. After finding the nearest Indekos or rented room, the user can view the more information about the Indekos by tapping on the Indekos point.

4.2. Floyd-Warshall Algorithm

We use 5 points to analyze A Star algorithm. These five points are arranged in a simple graph. The points can be seen in Figure 2.

In the figure, there are five points, such as S, A, B, C, and G. The starting point is S and the destination is G. The coordinates of each points are S (1,1), A (3,1), B (2,6), C (6,1), G (6.5). To get the value of $h(n)$ we will use the calculation of heuristic function. The heuristic function used is Euclidean Distance. This function provides better results than other heuristic functions [6]. For the value of $g(n)$ we will use the distance value ($j$) multiplied by the traffic congestion weight ($m$) to manipulate the weight of each points relation using Euclidean Distance formula, as shown in Equation 1.

$$d(x,y) = |\sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \cdots + (x_n - y_n)^2}$$

(1)

Calculate the heuristic value from the related point: S-A, S-B, A-C, A-G, A-B, B-C, C-G by using Euclidean Distance formula.

$$S(1,1) \text{ to } A(3,1)$$

$d(x,y) = |\sqrt{(1-1)^2 + (3-1)^2} = 2$

$$A(3,1) \text{ to } C(6,1)$$

$d(x,y) = |\sqrt{(3-1)^2 + (6-1)^2} = 5.38$

$$A(3,1) \text{ to } B(2,6)$$

$d(x,y) = |\sqrt{(3-1)^2 + (2-6)^2} = 4.47$

$$S(1,1) \text{ to } B(2,6)$$

$d(x,y) = |\sqrt{(1-1)^2 + (2-6)^2} = 4$

$$A(3,1) \text{ to } G(6.5)$$

$d(x,y) = |\sqrt{(3-1)^2 + (6-5)^2} = 2.23$

$$B(2,6) \text{ to } C(6,1)$$

$d(x,y) = |\sqrt{(2-6)^2 + (6-1)^2} = 6.4$

For the value of $g(n)$ taken from the distance value multiplied by the traffic congestion weight, as show in Table 1.

|      | S-A  | S-B  | A-C  | A-G  | A-B  | B-C  | C-G  |
|------|------|------|------|------|------|------|------|
| S-A  | 1x3  |      |      |      |      |      |      |
| S-B  | 4x2  |      |      |      |      |      |      |
| A-C  | 5x1  |      |      |      |      |      |      |
| A-G  | 12x3 |      |      |      |      |      |      |
| A-B  | 2x3  |      |      |      |      |      |      |
| B-C  | 2x2  |      |      |      |      |      |      |
| C-G  | 3x3  |      |      |      |      |      |      |

After getting the value of $h(n)$ and $g(n)$, then we will look for the value $f(n)$ using A Star algorithm with the formula:

$$f(n) = h(n) + g(n)$$

(2)
S is set as the starting point and G as the destination, then the value of f(n) points related to the point S is S-A and S-B.

\[
S - A = h(n) + g(n) = 2 + 3 = 5 \\
S - B = 4 + 8 = 12
\]

So, S-A route will be used because it provides the smallest f(n) value. Then proceed with the relation point A with other points are A-C, A-B, and A-G.

| Route | Distance |
|-------|----------|
| A-C   | 5.38 + 5 = 10.38 |
| A-G   | 2.23 + 36 = 38.23 |
| A-B   | 4.47 + 6 = 10.47 |

The smallest f(n) value is 10.38 provided by A-C route. Next, the other C-point relation is C-G.

\[
C - G = 5.09 + 9 = 14.09
\]

From the calculation, the A Star algorithm found that the shortest path is S-A-C-G.

5. Study and Result

System performance test is performed to determine the performance of the system in monitoring whether the system is running well or not. Test is performed on the buttons in the application to show the output of the system. Design of the application in this system starts with home activity with six buttons, labeled as Indekos, Kontrakan, Peta, Tentang, Bantuan, dan Keluar. The home activity can be seen in Figure 3.

![Home Activity of Application](image)

Figure 3. Home Activity of Application

Indekos and Kontrakan buttons show all the Indekos and rented room information from the database. The Indekos and rented room activity can be seen in Figure 4.

![Indekos Activity (a), Rented Room Activity (b)](image)

Figure 4. Indekos Activity (a), Rented Room Activity (b)

Peta button show the map integrated with Google Maps. There are several types of points in this map, such as faculties, dormitories, rented rooms, and traffic congestion points. The map activity can be seen in Figure 5(a). To find the nearest Indekos or rented room, user taps on the faculty to show pop up window that gives three options: cancel, nearest Indekos, and nearest rented room. The activity can be seen in Figure 5(b).
Once the nearest Indekos or nearest rented room is selected, the application will show the path from the selected faculty to the selected Indekos or rented room. The path is shown as red, blue, and green lines. After the path appears, we can zoom in the map to get better details of the path. The Indekos or rented room shown by the path can be tapped to get pop up information about Indekos or rented room. The path and pop up information of the Indekos and rented room can be seen in Figure 6.

From the test results, we can see that the A Star algorithm can find the shortest path from faculty to the nearest Indekos or rented room. In this case, bad internet connection will cause failure in routing and some path are not found. The success rate of this research can be seen in Table 2.

| Faculty                          | Nearest Indekos | Nearest Rented Room |
|----------------------------------|-----------------|---------------------|
| Kedokteran                       | Success         | Success             |
| Kesehatan Masyarakat             | Fail            | Success             |
| Ilmu Komputer & Teknologi        | Success         | Fail                |
| Informasi                        | Success         | Fail                |
From the test results of Indekost Android based application using A Star algorithm to find the shortest path from University of Sumatera Utara, we obtain the accuracy in process of finding the shortest path with 86.67% accuracy. The results of the accuracy value can be seen as follows:

$$\text{successful rate} = \frac{\text{number of success test}}{\text{number of test}} \times 100\% = 86.67\%$$

6. Conclusion
Based on the test results, the authors conclude that:
- A Star algorithm can be used to find the shortest path to Indekos from campus.
- Bad internet connection will cause failure in routing.
- Traffic congestion points are not really helpful and do not impress the path because almost every exit points from USU are traffic congestion points.

7. Suggestion
Here are some suggestions that can be used as considerations for further research:
- Further research is expected to find another location as the case so the impression of traffic congestion points in finding the path can be tested.
- Coordinate points must be determined accurately to get better results.
- Research implements different shortest path algorithm to compare the shortest path results.
- Further research can use standalone avoid internet connection problem when accessing map (Google Maps).

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