International Journal of Computer Technology and Science

E-ISSN: 3048-1961
P-ISSN: 3048-1899

Research Article

Implementation of the A* (A STAR) Algorithm in Searching the Closest Route from Pisangan Lama Jakarta Timur to Kampus Stikom CKI Pusat

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Abstract: Jakarta, the capital of Indonesia, is known for its high congestion levels. Data from the TomTom Traffic Index shows that Jakarta ranked 30th in the world in 2023 as one of the most congested cities, with a congestion level reaching 53% during peak hours. Pisangan Lama in East Jakarta is one of the densely populated areas, adjacent to busy roads. The main campus of STIKOM CKI, also located in East Jakarta, is situated along a route prone to heavy traffic. Given the congestion issues and the lack of information on the nearest routes, this study aims to implement the A* algorithm to find the shortest route from Pisangan Lama, East Jakarta, to the main campus of STIKOM CKI. The A* algorithm is chosen for its optimal routing capabilities. Based on research on three routes (Jl. I Gusti Ngurah Rai, Jl. Basuki Rachmat, and Jl. Raya Kalimalang), the results show that the route via Jl. Basuki Rachmat is the shortest, with a distance of 7.7 km. The implementation of the A* algorithm is expected to provide an efficient solution for the community in finding the nearest route.

Keywords: A* Algorithm, Congestion, Geographic Information System (GIS), Route Optimization, Shortest Path.

Received: November 15, 2023
Revised: December 12, 2023
Accepted: December 25, 2023
Published: January 15, 2024
Curr. Ver.: January 28, 2024

1. Introduction

Traffic congestion remains one of the most critical urban transportation challenges in major metropolitan areas worldwide, particularly in developing countries with rapidly growing populations and vehicle ownership. As the capital city of Indonesia, Jakarta consistently experiences severe traffic congestion that affects mobility, economic productivity, and residents' quality of life. According to the TomTom Traffic Index, Jakarta ranked among the most congested cities globally in 2023, with congestion levels significantly increasing travel times during peak hours. The situation is particularly evident in East Jakarta, where numerous traffic bottlenecks have been identified by local authorities. Several major roads connecting residential areas, business districts, public transportation hubs, and educational institutions frequently experience heavy traffic, causing delays for daily commuters. One of these strategic corridors is the route connecting Pisangan Lama and STIKOM CKI Central Campus, which is often affected by traffic density due to its proximity to major arterial roads and the Jakarta-Bekasi border area. Consequently, identifying an efficient route becomes increasingly important to reduce travel time and improve transportation effectiveness for students, employees, and other road users [1], [2].

Previous studies have demonstrated that shortest-path algorithms play an essential role in solving route optimization problems in various domains. The A* algorithm has been widely implemented because it combines path cost calculations with heuristic estimations, enabling efficient identification of optimal routes within graph-based environments. Research conducted in Banyumas successfully applied the A* algorithm to determine the shortest route to inpatient public health centers, resulting in improved accessibility and faster decision-making for emergency services. Similarly, studies in Yogyakarta utilized A* to optimize cultural tourism routes and reported shorter travel distances compared with conventional navigation approaches. Other investigations have implemented A* in transportation systems, geographic information systems, logistics distribution, mobile applications, and intelligent navigation platforms, demonstrating its effectiveness in finding shortest paths under different operational conditions. However, most existing studies focus on tourism, healthcare, logistics, and public service applications, while limited attention has been given to route optimization for daily commuting in highly congested urban corridors characterized by recurring traffic bottlenecks and complex road networks [3], [4].

Based on the identified problem and research gap, this study investigates the implementation of the A* algorithm to determine the nearest route from Pisangan Lama, East Jakarta, to STIKOM CKI Central Campus. The study is motivated by the practical need to support daily commuters in selecting more efficient travel routes within a traffic-prone environment. Specifically, the research seeks to answer two primary questions: (1) How can the A* algorithm be implemented to determine the nearest route between Pisangan Lama and STIKOM CKI Central Campus? and (2) How effective is the A* algorithm in identifying a shorter route when compared with routes generated by conventional navigation methods? Addressing these questions is important because route selection significantly influences travel duration, fuel consumption, and overall transportation efficiency. Furthermore, the study aims to evaluate whether the heuristic-based search mechanism of A* can provide practical advantages in urban route planning, particularly in areas where congestion frequently disrupts normal traffic flow and affects commuter mobility [5], [6].

This research contributes both theoretically and practically to the field of intelligent transportation and route optimization. From a theoretical perspective, the study enriches the body of knowledge concerning the application of heuristic search algorithms in urban navigation systems by examining their effectiveness in a real-world congestion context. Unlike previous studies that primarily focused on tourism destinations, health facilities, logistics services, or delivery systems, this research specifically addresses daily commuting challenges in a densely populated metropolitan environment. From a practical perspective, the proposed implementation can assist commuters in identifying more efficient routes, potentially reducing travel time and improving mobility around East Jakarta. The novelty of this study lies in the application of the A* algorithm to a specific congestion-prone corridor connecting Pisangan Lama and STIKOM CKI Central Campus, providing empirical evidence regarding its suitability for urban route optimization. The findings are expected to support the development of smarter navigation systems capable of improving transportation efficiency in congested urban areas [7], [8].

2. Literature Review

Systematic Literature Review (SLR)

Systematic Literature Review (SLR) is a structured and rigorous method used to identify, evaluate, and synthesize existing research related to a specific topic or research question. Unlike traditional literature reviews, SLR follows a predefined protocol to minimize bias and improve the reliability of findings. The primary objective of SLR is to provide a comprehensive understanding of the current state of knowledge while identifying research gaps and opportunities for future investigation. In route optimization studies, SLR is particularly useful because it enables researchers to analyze various implementations of shortest-path algorithms, compare methodologies, and evaluate their effectiveness across different application domains. Through systematic searching, screening, and analysis, researchers can obtain evidence-based conclusions regarding the strengths and limitations of a particular approach. In this study, SLR serves as the foundation for examining previous implementations of the A* algorithm in route-search applications, thereby supporting the identification of relevant theories, methods, and research gaps that justify the need for further investigation in urban navigation systems [1], [4].

Survey Methodology

Survey methodology is a research approach used to collect and analyze information from a selected sample representing a larger population. According to survey research principles, the objective is to identify patterns, relationships, and characteristics within a specific domain of investigation. In systematic reviews, survey methodology supports the process of identifying relevant studies and organizing evidence according to predefined criteria. One of the most widely used frameworks in this process is PICOC, which consists of Population, Intervention, Comparison, Outcomes, and Context. PICOC helps researchers formulate focused research questions and define the scope of the review. In the context of this study, the population refers to research involving the A* algorithm, while the intervention focuses on shortest-route search. The expected outcomes include improved route efficiency and navigation performance, whereas the context involves public transportation and urban navigation environments. By applying the PICOC framework, researchers can ensure consistency in selecting literature and increase the validity of the review process [7], [9].

Survey Protocol Review

A survey protocol is a predefined set of procedures that guides the process of literature identification, selection, and evaluation. The purpose of a survey protocol is to ensure transparency, repeatability, and consistency throughout the review process. In this study, the protocol includes publication year criteria, publication type selection, search strings, and study inclusion requirements. The selected studies were published between 2019 and 2024 and primarily consist of journal articles discussing the A* algorithm, geographic information systems, and shortest-route search applications. Keywords such as "A Star Algorithm," "GIS," and "Shortest Route" were used to retrieve relevant publications from digital libraries and academic databases. The protocol also involved screening titles, abstracts, and full-text articles to determine their relevance to the research objectives. Through this systematic procedure, only the most relevant studies were selected for detailed analysis. The application of a survey protocol enhances the credibility of the literature review and provides a solid theoretical foundation for the current study [2], [8].

This strategy includes the following stages:

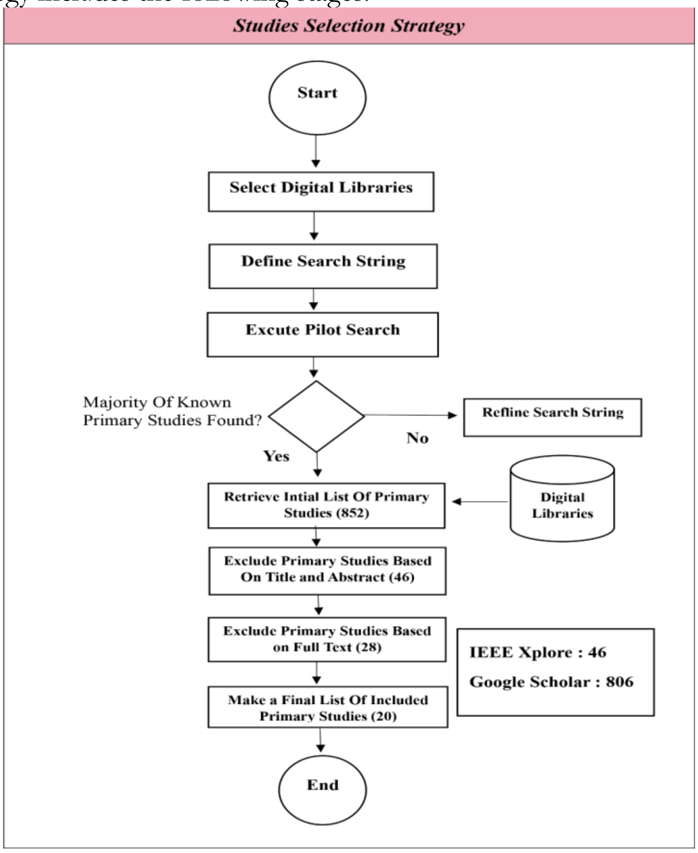

Figure 1. Study Selection Strategy.

Matriks Pebandingan

Based on a literature review related to the title of the thesis written, the author compiles a matrix of research problems, identifies various problems, and formulates research objectives comprehensively. All of this information is summarized thoroughly as follows.

Table 1. Comparison Matrix.

Research Problem		Research Question		Research Objective	
RP1	The need to find the nearest route on a congestion-prone route from Pisangan Lama, East Jakarta to STIKOM CKI Campus Center using Algooritma A*	RQ1	How to implement n algorithm A* to find the nearest route d From Pisangan Lama East Jakarta to STIKOM CKI Central?	RO1	Implementing Algorithm A*: Developing and implementing algorithm A* in a digital map-based navigation system to search for nearby routes.
		RQ2	How effective is the A* algorithm in finding the nearest route compared to the route generated by conventional navigation systems		

Definitions and Concepts

Algorithm

An algorithm is a sequence of logical and computational instructions designed to solve a specific problem or accomplish a particular task. In computer science, algorithms serve as the foundation for software development, data processing, optimization, and decision-making systems. An algorithm accepts input data, performs a series of operations, and produces output that satisfies a predefined objective. The effectiveness of an algorithm is often evaluated based on its accuracy, efficiency, and computational complexity. In route-search applications, algorithms are responsible for processing spatial data, evaluating possible paths, and identifying optimal routes between locations. Various shortest-path algorithms have been developed over time, including Dijkstra, Bellman-Ford, Floyd-Warshall, and A*. Each algorithm has unique characteristics and performance advantages depending on the complexity of the problem being solved. Therefore, understanding the concept of algorithms is essential before examining more specialized approaches such as A*, which has become one of the most widely adopted algorithms for pathfinding and navigation systems [10], [11].

A* (A-Star) Algorithm

The A* algorithm is an informed search algorithm designed to determine the shortest path between a starting point and a destination. It is widely recognized for its efficiency because it combines actual path costs with heuristic estimates of the remaining distance to the goal. The algorithm uses the evaluation function $f(n) = g(n) + h(n)$, where $g(n)$ represents the actual cost from the starting node to the current node, and $h(n)$ represents the estimated cost from the current node to the destination. By integrating these two values, A* can prioritize nodes that are likely to lead to an optimal solution while reducing unnecessary exploration. This characteristic makes A* more efficient than many traditional search algorithms. Numerous studies have demonstrated the effectiveness of A* in route planning, transportation systems, robotics, gaming environments, and geographic information systems. Consequently, A* has become one of the most popular algorithms for solving shortest-path problems in both academic research and real-world applications [12], [13].

Geographic Information System (GIS)

A Geographic Information System (GIS) is a computer-based system used to collect, store, process, analyze, and visualize spatial information. GIS integrates geographic data with descriptive attributes, allowing users to understand relationships between locations and physical environments. The technology is widely applied in transportation planning, environmental monitoring, urban management, disaster mitigation, and navigation systems.

In route-search applications, GIS provides the spatial framework necessary for representing road networks, intersections, landmarks, and destination points. GIS enables route-search algorithms to access accurate geographic information and perform spatial analysis efficiently. Furthermore, GIS supports visualization features that allow users to view route alternatives and geographical conditions on digital maps. The integration of GIS and shortest-path algorithms has significantly improved the effectiveness of navigation systems by combining computational analysis with intuitive map-based interfaces. As a result, GIS serves as a critical component in the development of intelligent transportation and route optimization solutions [8], [9].

Digital Maps and Google Maps

Digital maps are electronic representations of geographic information that allow users to visualize locations, routes, and spatial relationships through interactive interfaces. One of the most widely used digital mapping platforms is Google Maps, which provides road maps, satellite imagery, traffic information, and route-planning services. Google Maps has transformed navigation by enabling users to access real-time location data and travel recommendations from mobile devices and web applications. In research related to route optimization, digital maps often serve as sources of geographic data and benchmarks for evaluating algorithmic performance. While commercial mapping platforms provide highly effective navigation solutions, academic studies frequently implement custom route-search algorithms to investigate specific optimization strategies and problem contexts. Therefore, digital maps and route-search algorithms complement one another, with digital maps providing spatial visualization and route-search algorithms delivering computational intelligence for decision-making [3], [14].

Distance

Distance is a fundamental concept in route-search and navigation studies because it represents the separation between two locations. In transportation systems, distance is often used as a primary factor in determining route efficiency and travel costs. Several distance measurements can be applied depending on the problem context, including Euclidean distance, Manhattan distance, geodesic distance, and actual travel distance. Euclidean distance measures the straight-line separation between two points, while Manhattan distance calculates movement through horizontal and vertical paths. In A* implementations, distance measurements are frequently incorporated into heuristic functions to estimate the remaining cost to a destination. The selection of an appropriate distance metric significantly affects the accuracy and performance of route-search algorithms. Consequently, understanding the characteristics of different distance measures is essential for designing effective navigation systems and improving shortest-path calculations in urban environments [6], [15].

Qualitative Data

Qualitative data refers to non-numerical information used to understand phenomena, behaviors, experiences, and perceptions within their natural contexts. Unlike quantitative data, which focuses on measurable variables, qualitative data emphasizes interpretation and meaning. Common sources of qualitative data include interviews, observations, field notes, and document analysis. In transportation and navigation studies, qualitative data can provide insights into user behavior, route preferences, traffic experiences, and environmental conditions that influence travel decisions. Such information complements quantitative findings by explaining the contextual factors behind observed outcomes. For example, a route identified as optimal by an algorithm may not always be preferred by users due to congestion, safety concerns, or accessibility issues. Therefore, qualitative data contributes to a more comprehensive understanding of route-search problems and supports the development of practical solutions that align with real-world user needs [16], [17].

Traffic Congestion

Traffic congestion is a condition in which the volume of vehicles exceeds the operational capacity of a road network, resulting in reduced travel speeds and increased delays. Congestion is a common problem in urban areas due to population growth, increasing vehicle ownership, limited road infrastructure, and inefficient traffic management. The consequences of congestion include longer travel times, increased fuel consumption, environmental pollution, and reduced economic productivity. In highly populated cities such as Jakarta, congestion has become a significant transportation challenge affecting daily commuters. Route optimization technologies can help mitigate some of these impacts by identifying alternative paths and reducing unnecessary travel distance. Although route-search algorithms cannot eliminate congestion entirely, they can assist users in making more informed travel decisions. Therefore, understanding traffic congestion is essential for evaluating the practical relevance of shortest-path algorithms and their potential contribution to improving urban mobility and transportation efficiency [1], [2].

3. Materials and Method

Research Data

The research data used in this study consist of information collected through direct observation and supporting literature to evaluate the implementation of the A* algorithm in identifying the nearest route from Pisangan Lama, East Jakarta, to STIKOM CKI Central Campus. The study was conducted between May and June 2024, during which data collection, route observation, and analysis activities were carried out. The research location covered the travel corridor from Jl. Biduri Bulan 1 No. 18, Pisangan Lama, East Jakarta, as the starting point, to STIKOM CKI Central Campus located at Jl. Radin Inten II No. 8, Duren Sawit, East Jakarta, as the destination point. Data collection employed both primary and secondary sources. Primary data were obtained through direct observation of travel routes, particularly the route passing through Jl. I Gusti Ngurah Rai, conducted during different time periods on weekdays and weekends, as well as through observations using Google Maps to identify travel patterns. Secondary data consisted of twenty scholarly articles published between 2019 and 2024 focusing on the A* algorithm and shortest-route search. The main research attributes included geographic coordinates, starting point, destination point, and travel distance, which served as essential parameters in route analysis and algorithm implementation.

Methodology Implementation

This study applies the A* algorithm as the primary method for determining the nearest route between Pisangan Lama, East Jakarta, and STIKOM CKI Central Campus. The A* algorithm utilizes a Best First Search approach to identify the path with the lowest cost from the starting node to the destination node. The algorithm evaluates each possible path using the function $f(n) = g(n) + h(n)$, where $g(n)$ represents the actual cost from the starting node to the current node and $h(n)$ represents the estimated cost from the current node to the destination. The heuristic value $h(n)$ is calculated using the Euclidean Distance formula, which measures the straight-line distance between two coordinate points based on their latitude and longitude values. The research process consisted of four main stages. First, data were collected through direct field surveys to represent actual road conditions and route characteristics. Second, the collected data were analyzed using heuristic calculations within the A* algorithm framework. Third, the calculated heuristic values were implemented and evaluated using digital mapping applications, particularly Google Maps, to perform route analysis and determine the most efficient path. Finally, the study produced route-distance calculations and identified the nearest route as the final output of the research process.

If displayed visually, the stages of applying the methodology carried out by the author are as shown in the following image.

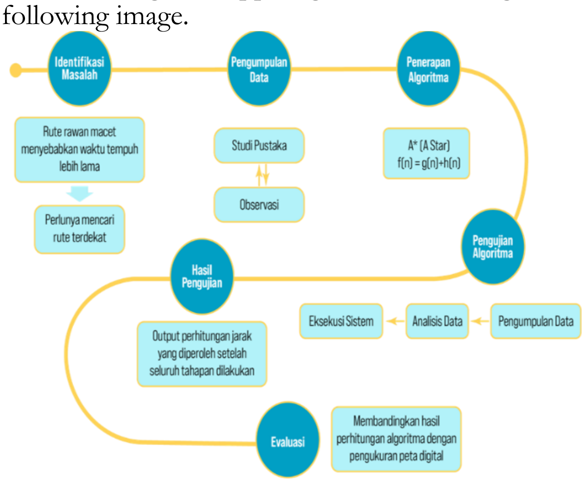

Figure 2. Research Stages.

Research Design

The research design was developed to evaluate the effectiveness of the A* algorithm in identifying the shortest and nearest route between the selected origin and destination points. The process began with determining the destination location, namely STIKOM CKI Central Campus, which served as the primary research object. Subsequently, a field survey was conducted to identify three alternative routes connecting Pisangan Lama, East Jakarta, to the destination. After the routes were identified, each intersection and significant turning point along the routes was marked to construct a grid-based representation of the road network. The coordinates of each grid node were then collected and recorded to establish spatial relationships among the connected routes. Based on these coordinates, distance calculations were performed to determine the travel cost between nodes. The next stage involved calculating heuristic values using the A* algorithm to estimate the remaining distance from each node to the destination. These heuristic calculations enabled the algorithm to identify the most efficient path by minimizing the total estimated cost. The final outcome of the research design was the determination of the shortest route and its corresponding travel distance, which served as the basis for evaluating the effectiveness of the A* algorithm in route optimization.

The research data of the A* algorithm test design that has been obtained can be seen in the following table.

Table 2. Research route data.

No.	Rute	Jarak Tempuh
1	Jl. Raya Bekasi Timur – Jl. I Gusti Ngurah Rai	9,5 km
2	Jl. Basuki Rachmat - Jl. Kolonel Sugiono	7,7 km
3	Jl. Laksamana Malahayati – Jl. Raya Kalimalang	10,1 km

4. Results and Discussion

Research Tools

In research, tools that support the smooth process are very important so that data collection can be carried out more efficiently, both in terms of time and energy. The tools used include software and hardware, both of which play a crucial role in ensuring that each stage of research runs smoothly and on time. With these tools, researchers can focus on data analysis and interpretation, while technical processes are carried out optimally.

Hardware

The hardware used by the author in this study is a laptop used for the entire research, starting from data processing and testing for the specifications listed in the following table:

Table 3. Hardware Specifications.

No.	Jenis Perangkat Keras	Spesifikasi
1.	*Processor*	Intel® Core™ i5-8300H @2.3GHz
2.	RAM	16GB DDR4 2666Mhz
3.	*Storage*	SSD 512GB, HDD 1TB
4.	GPU	NVIDIA GeForce GTX 1050 4GB GDDR5
5.	Operating System	Windows 10 Home Single Language 64bit

Software

To conduct this research, software is needed that has its own functions and roles in this research, the software used is as follows:

Table 4. Software specifications.

No.	Jenis Perangkat Lunak	Keterangan
1.	*Browser* (Microsoft Edge /Google Chrome)	To access/open a google maps page or digital map service Similar
2.	Adobe Illustrator	Used in grid creation, either separately or combined with pictures
3.	Microsoft Excel 365	As a place to store numerical data also a calculation tool.
4.	Microsoft Word 365	Used to describe data

This study uses the A* algorithm which is implemented on public data in the form of three travel routes to the Central STIKOM CKI campus. The three routes are the Pisangan Lama route to the Central STIKOM CKI campus via Jl. I Gusti Ngurah Rai, the Pisangan Lama route to the Central STIKOM CKI campus via Jl. Colonel Sugiono, and the Pisangan Lama route to the Central STIKOM CKI campus via Jl. Raya Kalimalang. All the route data will then be used to calculate the A* Algorithm to find the nearest route to the Central STIKOM CKI campus.

Implementation and Testing

The implementation and testing phase of this study involved collecting and analyzing route data to evaluate the effectiveness of the A* algorithm in determining the nearest route to STIKOM CKI Central Campus. Data collection was conducted through direct observation by traveling along three alternative routes from Pisangan Lama, East Jakarta, to the campus. The first route passed through Jl. I Gusti Ngurah Rai, the second through Jl. Kolonel Sugiono, and the third through Jl. Raya Kalimalang. Observations focused on capturing real-world conditions, including road characteristics, traffic density, travel patterns, and travel time along each route. After the data had been collected, a grid-based analysis was performed to model the road network and identify the possible paths connecting the origin and destination. The destination point was STIKOM CKI Central Campus, located on Jl. Radin Inten II, Duren Sawit, East Jakarta. Subsequently, heuristic calculations were applied using the A* algorithm to evaluate each node within the route network. By prioritizing nodes with the lowest estimated cost, the algorithm was able to identify the most efficient path. This process ensured that the selected route provided the shortest and most effective travel distance between the starting point and the destination.

Final Testing Results

The final testing phase began with the analysis of spatial data obtained from Google Maps, which was used to identify and visualize alternative routes from Pisangan Lama, East Jakarta, to STIKOM CKI Central Campus. The captured map images were transformed into a grid-based representation, and key intersections were assigned coordinate points to model the road network. Each grid index represented approximately 131 meters and was used to calculate the distances between connected nodes using the Euclidean Distance formula. Three alternative routes were evaluated: the route via Jl. I Gusti Ngurah Rai, the route via Jl. Basuki Rachmat, and the route via Jl. Raya Kalimalang. The total node distances obtained from the grid calculations were 72.547, 56.31, and 78.089 units, respectively. These values provided the foundation for applying the A* algorithm and enabled a structured comparison of the alternative routes based on their spatial characteristics and estimated travel distances.

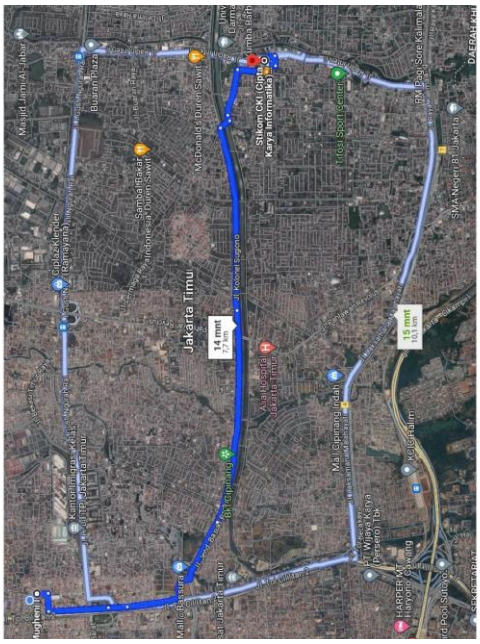

Figure 3. *Capture* the intersection route to the STIKOM CKI campus (source: Google Maps, 2024)

After determining the node distances, the A* algorithm was applied by calculating the evaluation function $f(n) = g(n) + h(n)$ for each route, where $g(n)$ represents the accumulated travel cost and $h(n)$ represents the heuristic distance to the destination. The results showed that the route through Jl. Basuki Rachmat produced the lowest total cost value, with $f(n) = 55.39$, followed by the route through Jl. I Gusti Ngurah Rai with $f(n) = 73.90$, and the route through Jl. Raya Kalimalang with $f(n) = 78.73$. After converting the grid values into actual distances using a scaling factor, the estimated route lengths were approximately 7.3 km, 9.75 km, and 10.3 km, respectively. A comparison with Google Maps distances demonstrated a high level of consistency, resulting in route accuracies of 97.44%, 94.82%, and 97.09%, with an average accuracy of 96.45%. These findings indicate that the A* algorithm was highly effective in identifying the shortest and most efficient route to STIKOM CKI Central Campus.

Table 5. Test Results.

Nama Rute	Algoritma A*	Jarak Google Maps	Akurasi
Jl. I Gusti Ngurah Rai	9.680m (9,68km)	9500m (9,5) km	97,44%
Rute Jl. Basuki Rachmat	7.256m (7,25km)	7700m (7,7 km)	94,82%
Rute Jl. Raya Kalimalang	10.313m (10,3km)	1100m (10.1km)	97,09%
	Rata-rata akurasi		96.45%

5. Conclusion

This study examined the implementation of the A* algorithm to identify the nearest route from Pisangan Lama, East Jakarta, to STIKOM CKI Central Campus. The results demonstrate that the A* algorithm is effective for shortest-route determination because it combines actual travel costs with heuristic estimates to guide the search process toward the destination. The algorithm was able to evaluate multiple route alternatives systematically and efficiently, making it suitable for route optimization problems in urban transportation networks. Furthermore, the calculation process of the A* algorithm is relatively straightforward and transparent, allowing users and researchers to understand how route decisions are generated through the evaluation of nodes and path costs.

The analysis of the three alternative routes Jl. I Gusti Ngurah Rai, Jl. Basuki Rachmat, and Jl. Raya Kalimalang revealed that the route through Jl. Basuki Rachmat is the shortest and most efficient path from Pisangan Lama to STIKOM CKI Central Campus. Based on the A* calculations and distance conversion process, this route produced the lowest total cost value and an estimated travel distance of approximately 7.3 km. In comparison, the routes through Jl. I Gusti Ngurah Rai and Jl. Raya Kalimalang resulted in longer distances of approximately 9.75 km and 10.3 km, respectively. These findings confirm the capability of the A* algorithm to identify the optimal route among several available alternatives within a complex road network.

The accuracy evaluation further demonstrated the reliability of the proposed approach. By comparing the calculated route distances with the corresponding distances obtained from Google Maps, the study achieved an average accuracy of 96.45%, indicating a high degree of consistency between the algorithmic results and real-world route measurements. This finding suggests that the A* algorithm can provide dependable route recommendations for navigation purposes. Future research may expand the study by incorporating additional travel routes, larger road networks, and dynamic traffic conditions such as congestion, road closures, or traffic incidents to further assess the adaptability and performance of the algorithm in real-time transportation environments.

References

[1] S. Susilawati, "Penerapan Metode A*Star Pada Pencarian Rute Tercepat Menuju Destinasi Wisata Cagar Budaya Menes Pandeglang," *Geodika J. Kaji. Ilmu dan Pendidik. Geogr.*, vol. 4, no. 2, pp. 192–199, 2020, doi: 10.29408/geodika.v4i2.2754.

[2] Y. Fernando, M. A. Mustaqov, and D. A. Megawaty, "Penerapan Algoritma A-Star pada Aplikasi Pencarian Lokasi Fotografi di Bandar Lampung Berbasis Android," *J. Teknoinfo*, vol. 14, no. 1, p. 27, 2020, doi: 10.33365/jti.v14i1.509.

[3] A. D. Cahyono, "Penerapan Algoritma A-Star untuk Mencari Rute Terpendek Destinasi Wisata Budaya Kota Yogyakarta," 2022.

[4] M. Ali and others, "Penerapan Algoritma A Star Untuk Pencarian Rute Terpendek Puskesmas Rawat Inap Di Banyumas."

[5] A. D. Sabilla and A. Taufiq, "Penerapan Algoritma A* pada WebGIS Pencarian Rute Terpendek," *J. Inf. Syst. Comput.*, [Online]. Available: https://journal.unisnu.ac.id/JISTER

[6] D. Marcelina and E. Yulianti, "Aplikasi Pencarian Rute Terpendek Lokasi Kuliner Khas Palembang Menggunakan Algoritma Euclidean Distance dan A*(Star)," *J. Sisfokom (Sistem Inf. dan Komputer)*, vol. 9, no. 2, pp. 195–202, 2020, doi: 10.32736/sisfokom.v9i2.827.

[7] A. Wildan, R. Ramadhan, and D. Udjulawa, "Perbandingan Algoritma Dijkstra dan Algoritma A-Star Pada Permainan Pac-Man," 2020.

[8] M. R. Akbar, I. Zufria, and A. M. Harahap, "Implementasi Algoritma A Star Pada Sistem Informasi Geografis Sekolah Luar Biasa di Kota Medan," *J. Comput. Digit. Bus.*, vol. 3, no. 1, pp. 18–25, 2024, doi: 10.56427/jcbd.v3i1.243.

[9] D. O. Pugas, M. Somantri, and K. I. Satoto, "Pencarian Rute Terpendek Menggunakan Algoritma Dijkstra dan Astar (A*) pada SIG Berbasis Web untuk Pemetaan Pariwisata Kota Sawahlunto," 2011, [Online]. Available: http://mapserver.gis.umn.edu

[10] A. F. Warshall and others, "InfoTekJar: Jurnal Nasional Informatika dan Teknologi Jaringan," *InfoTekJar*, vol. 5, no. 1, 2020, doi: 10.30743/infotekjar.v5i1.2496.

[11] D. Ardana and R. Saputra, *Penerapan Algoritma Dijkstra pada Aplikasi Pencarian Rute Bus Trans Semarang*. 2016.

[12] D. Hermanto and S. Dermawan, "Penerapan Algoritma A-Star Sebagai Pencari Rute Terpendek pada Robot Hexapod," *J. Nas. Tek. Elektro*, vol. 7, no. 2, p. 122, 2018, doi: 10.25077/jnte.v7n2.545.2018.

[13] I. Bagus, G. Wahyu, and A. Dalem, "Penerapan Algoritma A* (Star) Menggunakan Graph untuk Menghitung Jarak Terpendek," 2018, [Online]. Available: http://jurnal.stikiindonesia.ac.id/index.php/jurnalresistor

[14] D. Luthfita and S. Aripin, "Implementasi Algoritma A* Dalam Menentukan Tarif Minimum Berdasarkan Jarak Terpendek Rute Armada Taksi Bandara," 2022, [Online]. Available: https://hostjournals.com/

[15] R. Azhar, "Perbandingan Perhitungan Manual dengan Algoritma A Star dalam Pencarian Jalur Terpendek untuk Pengiriman Pesanan Dodol Khas Lombok," *J. Inform. dan Rekayasa Elektron.*, vol. 2, no. 2, 2019, [Online]. Available: http://e-journal.stmiklombok.ac.id/index.php/jire

[16] T. Suhendra and others, "Jurnal Sustainable: Jurnal Hasil Penelitian dan Industri Terapan," vol. 6, no. 1, pp. 16–23, 2017.

[17] A. Setiyawan and others, "Pencarian Jalur Terpendek untuk Penjemputan Barang Kiriman Pelanggan Mitra (Studi Kasus pada Kantor Pos Malang)," vol. 5, pp. 1–7, 2019.