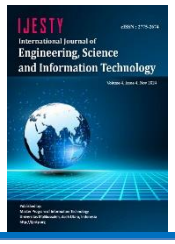
International Journal of Engineering, Science and InformationTechnology
Volume 4, No. 4 (2024) pp. 237-243
ISSN 2775-2674 (online)
Website: http://ijesty.org/index.php/ijesty
DOI: https://doi.org/10.52088/ijesty.v4i4.650
Research Paper, Short Communication, Review, Technical Paper



Geographic Information System of Early Childhood School Mapping Using Android-Based Dijkstra Algorithm

Rasna[1]*, Moh Rahmat Irjii Matdoan[2], Lily Yuntina[3], Junaidi Salat[4], Eka Setiawati[5]

[1]Department of Information System, Universitas Yapis Papua, Indonesia
[2]Department of Informatics, Universitas Sains dan Teknologi Jayapura, Indonesia
[3]Department of PG PAUD, Universitas Pancasakti Bekasi, Indonesia
[4]Universitas Jabal Ghafur, Aceh, Indonesia
[5]Department of PAUD, Universitas Setia Budhi, Indonesia

**Corresponding author Email: razna.anwar@gmail.com*

The manuscript was received on 18 April 2024, revised on 26 August 2024, and accepted on 16 November 2024, date of publication 26 November 2024

Abstract

The PAUD school mapping geographic information system (GIS) is an innovative Android-based application designed to efficiently assist users in finding the closest route to PAUD schools. By leveraging GPS technology, this system displays a detailed geographic map that guides users effectively through their surroundings. At the core of its functionality is the Dijkstra Algorithm, which ensures the calculation of the shortest path to the desired location, making navigation straightforward and reliable. The design process employs UML (Unified Modeling Language) to create a clear structure and user-friendly interface, enhancing the overall user experience. Developed in Java and supported by the Android Studio platform, this GIS provides essential information about PAUD addresses, their statuses, and available facilities. This comprehensive approach allows users to make informed decisions about educational opportunities for their children. The system has undergone rigorous testing to validate its effectiveness. This practical application demonstrates the system's capability in real-world scenarios and highlights its role in improving access to early childhood education. Furthermore, the PAUD mapping geographic information system is a valuable community resource. By delving into geographic data and providing actionable insights, it aims to bridge gaps in educational access. Ultimately, this GIS is an essential tool for parents and educators, facilitating informed choices and enhancing the journey toward quality education for young learners. Its integration of modern technology with educational accessibility makes it an ultimate resource in fostering early childhood development.

Keywords: *GPS, Dijkstra Algorithm, Java, UML, Android App Studio*.

1. Introduction

The need to obtain information quickly and efficiently has become a basic need for the world community, including the Indonesian community. One piece of information the community needs at this time is geographic information [1]. Geographic information systems (GIS) have recently experienced significant developments along with advances in information technology [2].
Human development is not sufficient with healthy physical growth alone but needs to be complemented by the growth of the child's brain [3]. Early childhood education is offered in every region of Indonesia. [4]. Many parents want their children to be good people, so they put them in daycare schools. One of the characteristics to improve children's brain development is to instill character values in students, which include knowledge, awareness or willingness, and actions to implement the values of goodness and virtue to God Almighty, oneself, others, the environment, and the nation to become a person with morals [5].
XYZ City is one of the strategic areas, especially in the ABC District, because it is located on the Sumatra route. When the community does not know the location of the early childhood education school and wants to find a preschool in ABC District, XYZ City. These obstacles include the lack of information about where the place or location is and the shortest route to the place from where it will be

headed. Another solution is to create this application using Android, an application in the form of a map showing a map to determine the location to be headed.
One of the searches applied to find the shortest path, but this algorithm can also be used for undirected graphs [6]. Dijkstra's algorithm searches for the shortest route in several steps. Dijkstra's algorithm is one of the solutions used to determine the location [7].

2. Literature Review

The law on the National Education System, it is stated that Early Childhood Education (PAUD) is an effort to provide guidance aimed at children from birth to the age of six years, which is carried out through the provision of educational stimulation to help physical and spiritual growth and development so that children are ready to enter further education (Law Number 20 of 2003 Chapter I Article 1 paragraph 14). Early Childhood Education can be implemented in formal, non-formal, and informal forms [8]. Each form of organization has its characteristics. The organization of early childhood education on the formal path is Kindergarten (TK) or RA and similar institutions. The organization of education for early childhood on the non-formal path is organized by the community based on the needs of the community itself, especially for children who, due to their limitations, are not served in formal education (TK and RA). The family or environment carries out education on the informal path. Informal education aims to provide religious beliefs, instill cultural values, moral values, ethics, personality, and aesthetics, and improve the knowledge and skills of students to achieve national education goals [9]. Early childhood education is organized to facilitate the growth and development of children and emphasize the development of all aspects of the child's personality [10].
A system can be defined as a collection or set of components or variables that are organized, interact with each other, and are interdependent [11]. Information is data processed into a form with meaning for the recipient and real and tangible value for current or future decisions [12]. Information is data that results from processing and has meaning, usually telling the User something that is not yet known [13].
An information system is a collection of interrelated computer components that collect, process, store, and provide output information needed to complete business tasks [14].
Android Studio is Google's primary integrated development environment (IDE) for developing on the Android platform because Android Studio is an IDE from Google. This software can be directly integrated with the Google Maps API to combine maps with software so that maps will be automatically displayed in the created application. In addition to integration from Google Maps, Android Studio can also be integrated with the SQLLite Manager database, a plugin for processing and storing interrelated information to create algorithms from each data displayed [15].
The method that will be used to find the shortest route to be implemented in ABC District, XYZ City, is the Dijkstra method. [16]. Edsger Wybe Dijkstra discovered the Dijkstra method in 1959, which functions to determine the shortest route. Therefore, this program does not provide alternative routes [17]. Dijkstra's algorithm is a popular form of algorithm for solving problems related to optimization problems [18]. By the meaning of greedy, which means greedy or gluttonous, but not in a negative context, this greedy algorithm only thinks about the best solution to be taken at each step without thinking about the consequences in the future [19].
UML is a synthesis of three object-based analysis and design methods, plus the advantages of other object-oriented methods that are also synthesized in UML, offering a pretty good approach that has been used in the software industry [20].

3. Methods

This research was conducted at the Department of Education and Culture of XYZ City and early childhood education schools (PAUD) in ABC District, XYZ City. This research will be conducted for ± 3 months.
The data collection methods used in this study are as follows :

1. Literature study
   Studying existing books and materials or other sources that support the research object.
2. Observation
   Collecting data and information and observing existing nearby location search applications as references.
3. Interviews
   Data collection is only done by interviewing parties who are considered experts and competent regarding geographic information systems, including the XYZ Education and Culture Office and early childhood education schools (PAUD).

As for the creation of an application for mapping early childhood education schools in ABC District, XYZ City, several things must be done.

1. Location Visit
   At this stage, the author visits the intended location to be able to see the area directly.
2. Determining the search algorithm
   The researcher chose the Dijkstra algorithm to carry out the routing process for this information system. This is because many articles, papers, and tutorials already discuss this algorithm.

The system scheme for the PAUD mapping information system is as shown in the image below :

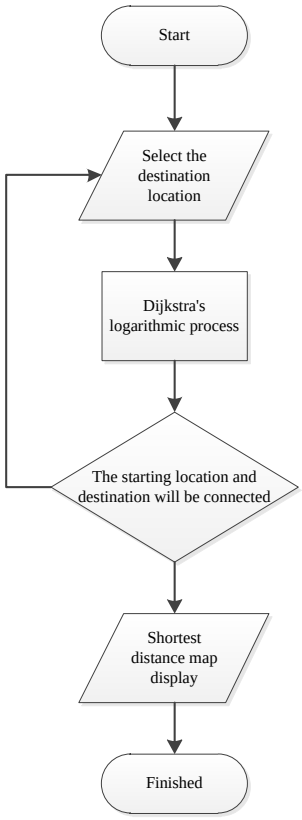


Fig 1. System Schematic

Figure 1 shows that the User selects the destination location, which the Dijkstra algorithm will then process, and the initial location will be connected to the destination location. If not, it will return to the initial selection. If yes, the system will display a finished map of the shortest distance.

The system architecture explains the components contained in the system. The architectural design can be seen in the following image.

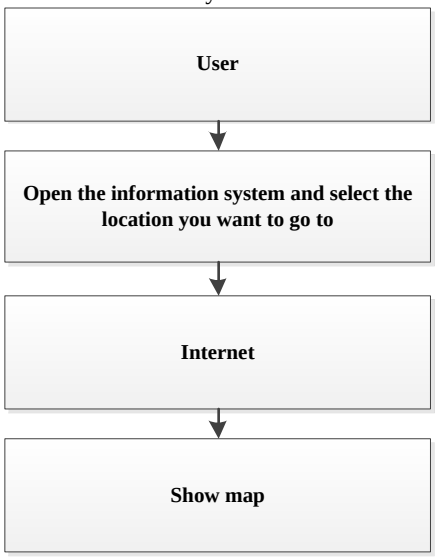


Fig 2. System architecture

4. Result and Discussions

System analysis aims to identify problems in the system where the information system is built, including the operating environment, users, and related elements. Analysis of the system is needed as a basis for the system design stage, which includes system design, system design, and implementation. The following design uses a use case diagram explaining how this application runs in simple terms.

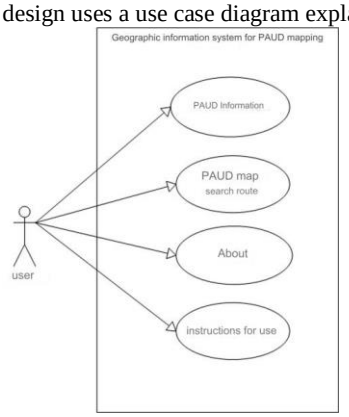


Fig 3. Use case diagram

The following design uses an activity diagram to create a geographic mapping information system application for PAUD mapping.

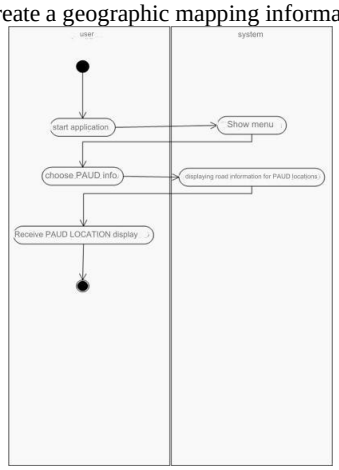


Fig 4. Activity diagram of PAUD information menu

This activity diagram shows the activities that run when the User selects the PAUD Information menu in the main menu. When the User selects the PAUD Information menu, the system will display the PAUD address.

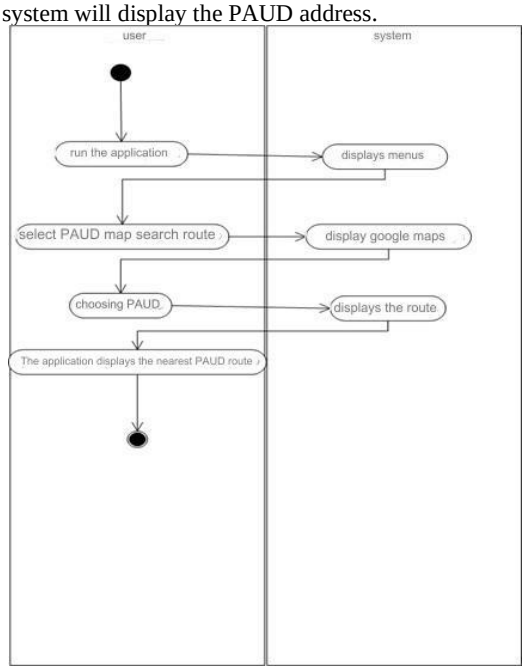


Fig 5. PAUD search activity diagram

This activity diagram shows the activities that run when the User selects the PAUD ABC Map Search Route menu in the information system menu. When the User selects the PAUD Map Search Route menu, the system will display a Geographic map and PAUD nodes; the User can determine the PAUD input to be visited, and the system will display the closest route to that location.

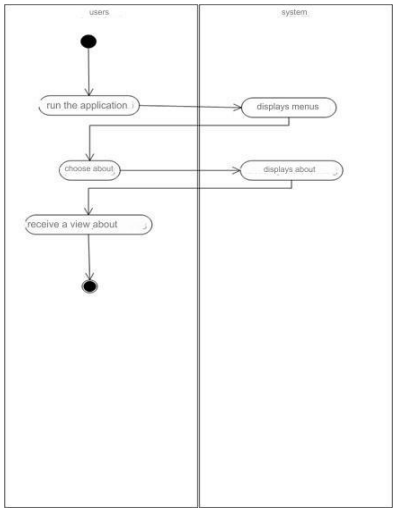


Fig 6. Activity diagram about the system

In the picture above is the About menu; users can see information related to creating this PAUD mapping geographic information system application. When the User runs the system, the system will display the main menu; after that, the User selects the about menu, and the system will display about the system, and the User will receive a display from the system.

The following design uses Sequence Diagrams to create a geographic information system for PAUD mapping.

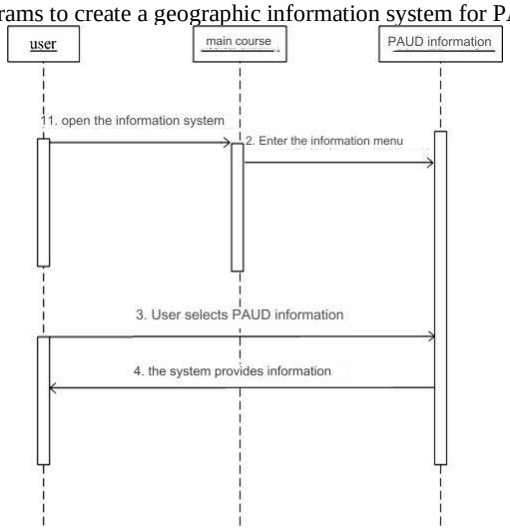


Fig 7. Sequence diagram of PAUD information

The sequence diagram above shows the process in the PAUD information menu. This process begins when the User opens the information system and selects the PAUD information menu on the menu, then, the system will display information on the location of the PAUD and the address of the PAUD.

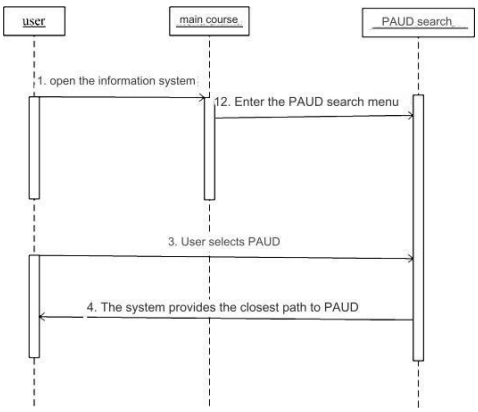


Fig 8. Sequence diagram of information system

The sequence diagram above shows the process in the PAUD menu. This process begins when the User opens the information system, and the main menu will appear. After that, the User selects the PAUD menu on the menu, and then the system will display the PAUD mapping geographic information system.

In this manual calculation section, the search for the nearest path, Dijkstra, will be discussed, as well as the application of the algorithm Dijkstra in searching for the nearest road route in PAUD. If someone is at location A (user location) and wants to go to PAUD C (PAUD A), we will create possible routes to solve the problem and determine the shortest path.

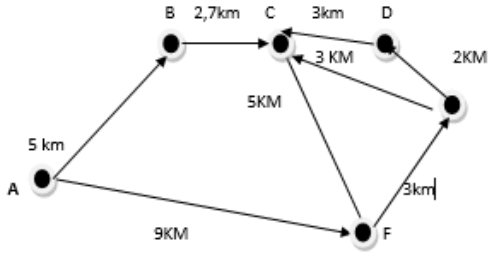


Fig 9. Starting point path

A = Lokasi User
B = PAUD B
C = PAUD C
D =PAUD D
E = PAUD E
F =PAUD F

In this case, the User is right at the pipeline intersection and wants to find the shortest route to the B PAUD location on Sumatera Street. Possible routes that can lead to this road are:
The first possibility is to go to PAUD (C):

1. Tracks A-B-C = 5000 M + 2700 M = 7,7 Km
   The second possibility is towards Paud (C):
2. Tracks A-F,E,D = 9K +3KM+2KM+ KM= 17 Km
   The third possibility is towards (C):
3. Tracks A-F-E-C = 9KM+3+3KM =15KM
   From Routes 1, 2, and 3, the shortest distance obtained is the first route, 7700 M. So the solution using Dijkstra's method is route A-B-C on this route.

The following is a table of problem-solving in finding the closest path using the Dijkstra algorithm, with a case study of the User being at A and the destination being C. The following are the steps.

Table 1. Values of each path

A	B	C	D	E	F
0	∞	∞	∞	∞	∞
a	5	∞	∞	∞	9
b	0	2,7	∞	∞	∞
f	∞	5 km	∞	3 km	0
e	∞	3 km	2 km	0	∞
d	∞	3 km	0	∞	∞

In Table 1. are the values of all distances where the calculation of A-B is 2.7 km and B-C is 2 km, then the closest route to location C is obtained, namely A-B C with an overall value of 7.7 km.

5. Conclusion

The conclusions obtained from this study are as follows:

1. This Android-based geographic information system is a simple information system that helps users find PAUD schools in the ABC XYZ district.
2. This Geographic Information System can help users find out the address and status of the PAUD.
3. From the calculations and testing of the selected route to PAUD C, the closest route is 7.7 km.

References

[1] Cecilia and Sarjono, "Analisis dan Perancangan Sistem Informasi Geografis Lokasi Sekolah di Kabupaten Maro Jambi," *J. Manaj. Sist. Infromasi*, vol. 4, no. 4, pp. 400–409, 2019.

[2] U. F. Kurniawati *et al.*, "Pengolahan Data Berbasis Sistem Informasi Geografis (SIG) di Kecamatan Sukolilo," *SEWAGATI*, vol. 4, no. 3, 2020, doi: 10.12962/j26139960.v4i3.8048.

[3] A. N. Faudillah, F. Nasution, A. F. Munthe, and S. Humairah, "Dampak Stres Terhadap Perkembangan Otak Anak," *J. Ris. Golden Age PAUD UHO*, vol. 2, no. 2, p. 167, 2019.

[4] B. Chantika, A. W. Dwi, L. Dwi, and A. Pagarwati, "Analisis Pembelajaran Seni Anak Usia Dini melalui Kegiatan Finger Painting," *Lect. J. Early Child. Educ.*, vol. 7, no. 2, pp. 79–91, 2024, doi: 10.31849/paud-reading.v.

[5] S. R. Amriani and S. Halifah, “Pengaruh Model Pembelajaran Kolaboratif terhadap Kecerdasan Interpersonal Anak Usia Dini,” *Lect. J. Pendidik. Anak Usia Dini*, vol. 7, no. 2, pp. 24–37, 2024, doi: 10.31849/paud-lectura.v.
[6] S. W. H, Y. Salim, and N. Kurniati, “Penerapan Metode Dijkstra Untuk Menentukan Lokasi Dan Jarak Tempuh Terpendek Kampus Umi Makassar,” *Bul. Sist. Inf. dan Teknol. Islam*, vol. 2, no. 3, pp. 197–207, 2021, doi: 10.33096/busiti.v2i3.897.
[7] A. Cantona, F. Fauziah, and W. Winarsih, “Implementasi Algoritma Dijkstra Pada Pencarian Rute Terpendek ke Museum di Jakarta,” *J. Teknol. dan Manaj. Inform.*, vol. 6, no. 1, pp. 27–34, 2020, doi: 10.26905/jtmi.v6i1.3837.
[8] D. Syamsi, P. Imanti, A. Harsika, K. A. Pratiwi, and R. Ariyani, “Edukasi Orang Tua dalam Membangun Kesiapan Anak Mengikuti Pendidikan di Pesantren,” vol. 13, no. 2, pp. 167–188, 2024.
[9] P. A. Putri, V. Adriany, H. Yulindrasari, and T. Dahlan, "Male And Female Teachers' Perspectives on Gender Roles In Early Childhood Education," vol. 13, no. 2, pp. 158–166, 2024.
[10] V. R. Rosalinda and N. I. Rusdiani, “Penggunaan Media Pembelajaran Audiovisual PowerPoint Untuk Mengenalkan Nama Hewan dalam Bahasa Inggris,” vol. 5, 2024, doi: 10.29240/zuriah.v5i1.9316.
[11] M. Putra Rasidin and H. Ma’sum, “Analisis Sistem Informasi Pendataan Kependudukan Kampung Areng Dengan Menggunakan Laravel,” *Simtek J. Sist. Inf. dan Tek. Komput.*, vol. 9, no. 1, pp. 10–15, 2024, doi: 10.51876/simtek.v9i1.361.
[12] D. Dwiyanti, D. Irmayani, and V. Sihombing, “Optimal Biaya Pengiriman Beras Menggunakan Model Transportasi Motode North Westh Corner (NWC),” vol. 7, no. September, pp. 355–359, 2024.
[13] T. S. Maulidda and S. M. Jaya, “Perancangan Sistem Informasi Berbasis Web Melalui Whatsapp Gateway Studi Kasus Sekolah Luar Biasa-Bc Nurani,” *J. Teknol. Inf. dan Komun.*, vol. 11, no. 1, pp. 38–44, 2021, doi: 10.56244/fiki.v11i1.421.
[14] M. I. Suri and A. S. Puspaningrum, “Sistem Informasi Manajemen Berita Berbasis Web,” *J. Teknol. dan Sist. Inf.*, vol. 1, no. 1, pp. 8–14, 2020, doi: 10.33365/jtsi.v1i1.128.
[15] N. H. Sinaga, D. Irmayani, and M. N. S. Hasibuan, “Mengoptimalkan Keamanan Jaringan Memanfaatkan Kecerdasan Buatan Untuk Meningkatkan Deteksi Dan Respon Ancaman,” *J. Ilmu Komput. dan Sist. Inf.*, vol. 7, no. 2, pp. 364–369, 2024.
[16] C. S. Rahayu, W. Gata, S. Rahayu, A. Salim, and A. Budiarto, “PENERAPAN ALGORITMA DIJKSTRA DALAM PENENTUAN LINTASAN TERPENDEK MENUJU UPT. PUSKESMAS CILODONG KOTA DEPOK,” *J. Tek. Inform. Atmaluhur*, vol. 3, no. 1, p. 82, 2020.
[17] N. Awalloedin and W. Gata, “Algoritma Dijkstra Dalam Penetuan Rute Terpendek Pada Jalan Raya Antar Kota Jakarta - Tangerang,” *Just IT J. Sist. Informasi, Teknol. Inf. dan Komput.*, vol. 13, no. 1, pp. 8–13, 2022.
[18] B. lutfi A. Rofiq, H. Februariyanti, J. S. Wibowo, and Z. Budiarso, "Pencarian Tempat Ibadah Terdekat Menggunakan Algoritma Dijkstra," *JUSIM (Jurnal Sist. Inf. Musirawas)*, vol. 6, no. 1, pp. 19–28, 2021, doi: 10.32767/jusim.v6i1.1138.
[19] H. Susanto, M. Yetri, and I. Mariami, “Implementasi Metode Dijkstra Untuk Mencari Jarak Terdekat Dalam Melakukan Pengiriman Paket Di PT.PMH," *J. Cyber Tech*, vol. 3, no. 10, pp. 1–12, 2020.
[20] K. Nistrina and L. Sahidah, “Unified Modelling Language (Uml) Untuk Perancangan Sistem Informasi Penerimaan Siswa Baru Di Smk Marga Insan Kamil,” *J. Sist. Inf.*, vol. 04, pp. 12–23, 2022.