



Go-Gallon App With A Star (A*) Algorithm Implementation Using Android Kotlin

Khusaeri Andesa¹, Herwin², Torkis Nasution³

^{1,2,3}Program Studi Manajemen Informatika, STMIK Amik Riau,
Jl.Purwodadi Km.10 Panam Pekanbaru

Article Info

Article history:

Received 03 17, 2022

Revised 05 10, 2022

Accepted 06 18, 2022

Keywords:

A STAR (A*)

Kotlin

Android

Abstrak

The need for drinking water now is not to boil water, but to buy it in the form of gallon bottles, which are available wherever it is sold, either at the refill of water or in the supermarket. In a housing estate with many heads of families, it is also difficult to find and obtain water in gallon bottles under certain conditions, and there is also the problem that there is only one brand of gallon bottles, which also makes it difficult to obtain. For this reason, the author provides a solution by creating a go-gallon application with the application of the A-Star (A*) algorithm to be able to detect the service takers of the nearest people, which is basically intended for residential environments, where with this application others can ask to find and purchase gallons and then deliver them to their homes. The A-Star algorithm is one of the distance search algorithms that has an optimal and complete ability to solve problems related to finding or determining a route with the least distance. The hope is that with this application, especially housewives, there is no need to worry when they run out of gallons of drinking water at home, enough with this application, these problems can be overcome.

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Corresponding Author:

Khusaeri Andesa

Program Studi Teknik Informatika

STMIK Amik Riau,

Jl.Purwodadi Km.10 Panam Pekanbaru

Email: khusaeri@sar.ac.id

©Khusaeri Andesa, Herwin dan Torkis Nasution 2022

1. Introduction

In today's modern times, technology is developing rapidly. The advances in technology and communication make people's need for quick and accurate information even greater. This situation encourages people to continue to conduct various kinds of experiments and researches to develop and discover new ways to help people perform their activities. Housewives usually rarely consume home-boiled drinking water, so housewives buy high-quality bottled water.

Problems in the selection and purchase of quality water affect the ease of obtaining the desired litres of water. This can be seen in the example of the research object that the author studied in the street of the self-employed. The problem is that the housewives have doubts about the quality of bottled water. Therefore, the housewives have to buy high quality bottled water in supermarkets or mini-markets. With this

application, housewives can easily buy high quality bottled water. In this research, A Star Algorithm (A*) is used to determine the nearest route. The A* algorithm (A Star) is one of the optimal and complete algorithms for route finding. Optimal means that the resulting route is the best and most complete route so that the algorithm can achieve the expected goal. In its application, the A* (A Star) algorithm uses distance as a calculation method for the best value.

Research using this method has been successfully conducted by many researchers including (Fernando, Mustaqov, and Megawaty 2020) in terms of finding location routes or photo spots in the city of Bandar Lampung using the A-Star method. Photo was successfully developed an application that contains photo spot information in Bandar Lampung with detailed information that is easily accessible by users [1]. In terms of applying the A* algorithm for finding the shortest route to the hospital in Bogor City was built using Android Studio software, using Java and XML programming languages for the user interface [2]. Based on the existing problems and what the researcher did with the method to be used, the author cast the method into a paper titled "go-gallon application with the application of the a star (a*) algorithm using android kotlin".

2. Literature Review

2.1. Application

A mobile application is software that runs on a mobile device such as a smartphone or tablet PC. Mobile applications are also called downloadable applications and have certain features to extend the functionality of the mobile device itself. To get the mobile application they want, users can download it through certain websites, depending on the operating system they have. Google Play and iTunes are some examples of websites that provide a variety of applications for Android and iOS users to download the desired application [3].

2.2. Algorithm A Star (A*)

A* is an algorithm first developed in 1964 by Nils Nilsson based on Dijkstra's algorithm. At that time, this algorithm was called the A1 algorithm. In 1967, Bertram Raphael further developed this algorithm and called it A2, but could not prove its superiority over the previous algorithm. In 1968, Peter E. showed that the A2 algorithm was optimal compared to A1. As a result, the A2 algorithm was found to be the most optimal algorithm for this case and was renamed A*. In terms of time, this algorithm is better than Dijkstra's algorithm with heuristic search [4]. Then, A is moved to the end that has the smallest F-value. The node in front of A is stored as a parent of A and included in a closed list (where the data of the node in front of A that is also part of the successfully found shortest path is stored). If there are other nodes that are neighbors of A (that have moved) but are not included in the open list members, then enter those nodes into the open list. Then compare the existing G-value with the previous G-value (in the first step, there is no need to compare the G-value). If the previous G-value is smaller, A returns to the initial position. The sampled node is added to the completion list. This is repeated until there is a solution or no other node is left in the open list [4]. Then A is moved to the closure that has the smallest F value. The node in front of A is stored as a parent of A and included in a closed list (which stores the data of the node in front of A that is also part of the successfully determined shortest path). If there are other nodes that are neighbors of A (that have moved) but are not included in the open list members, then enter those nodes into the open list. Then compare the existing G-value with the previous G-value (in the first step, there is no need to compare the G-value). If the previous G-value is smaller, A returns to the initial position. The sampled node is added to the completion list. This is repeated until there is a solution or no other node is left in the open list [4].

2.3. Ant Colony Optimization

Ant colony optimization or the ant algorithm was introduced by Moyson and Manderick and widely developed by Marco Dorigo. The ant algorithm is a bioinspired metaheuristic with a special group that attempts to mimic the behavioral characteristics of social insects, namely ant colonies [6]. The behavior of each perpetrator mimics the behavior of living ants and how they interact with each other to find a food source and efficiently bring it to their colony. During the walk, each ant emits pheromones to which the other ants are sensitive, giving them hope to follow in their footsteps. The intensity depends more or less on the concentration of the pheromones/pheromones. Pheromones/Pheromones are chemical compounds possessed by insects, especially ants, that are left on the ants' trails.

After some time, the shortest path will be followed more often and its pheromones become colonies. To simplify the process of designing the system, an analysis is needed before carrying out the next process. The analysis carried out is the inputting of the point of departure, the nodes created at the crossroads and the distance between the nodes. Here is the calculation formula used in the application of the A star method.

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

$f(n)$ = Evaluation function of node n

$g(n)$ = Cost or the distance from the origin node to n

$h(n)$ = The heuristic function of the n node, the heuristic function used is the straight line distance from the n node to the destination.

The working principle of the A* algorithm can be explained by the pseudocode below:

1. Input the initial node to the openlist.
2. Loop Steps below:
 - a. Look for the node (n) with the lowest $f(n)$ value in the openlist. This node is now the current node.
 - b. Remove the current node from the openlist and input it to the closelist.
 - c. For each neighbor of the current node do the following:
 1. If it's impassable or already in the closelist, ignore it.
 2. If it is not already on the openlist. Create a current parent node of this neighboring node. Store the f, g and h values of this node.
 3. If it is already on the openlist, check if this neighboring node is better, using the value of g as a measure. If it is better to change the parent of this node in the openlist to the current node, then recalculate the g and f values of this node.
 - d. Stop the loop if:
 1. The destination node has been added to the openlist, which means the route has been found.
 2. Haven't found the goal node while the openlist is empty or means no routes
3. Save the route. In 'backward', the sequence from the goal node to the parent continues until it reaches the initial node while saving the node into an array.

2.4. Android

Android is a Linux-based operating system for cell phones such as smartphones and tablet computers. Android provides an open platform for developers to create their own applications for a variety of mobile devices. Android is commonly used in smartphones and tablet computers. It works the same way as Nokia's Symbian operating system, Apple's iOS, and BlackBerry OS [5].

Android is an operating system developed by Google based on a Linux kernel to support the performance of touch-screen electronic devices such as tablets or smartphones. Thus, Android is operated by touching, swiping, or tapping on the device's screen. Android is open source and can be freely used, modified, repaired and distributed by software manufacturers or developers. Since Android is an open source technology, companies use it OS on their devices without a license, i.e. free of charge.

2.2. Research Methodology

2.2.1. Methodology of Research

The research methodology is the order of conducting the research. It is intended for a more conceptual and focused research according to the objectives to be achieved, in order to create a system that has been tested and can solve the problems studied (Bulan Dewi Gulita, 2018). In this research methodology, it is described in the form of a research framework that starts with problem identification, data collection, observation, analysis, system design, program creation, testing, and evaluation, where the research methodology is presented as follows:



Figure 1. Research Framework

2.2.2. A-Star Method Testing

The A-star algorithm in this system is applied to the user's movement to reach the location of mineral water sales through the nearest channels. The author takes the distance of the users located at Jl. Swakarya and Indomaret Subrantas 13 as the target. To get more accurate measurement results. The author uses Google Maps to determine the paths to travel. 7 nodes are generated from the projections of Google Maps, and the node finding is based on an intersection.

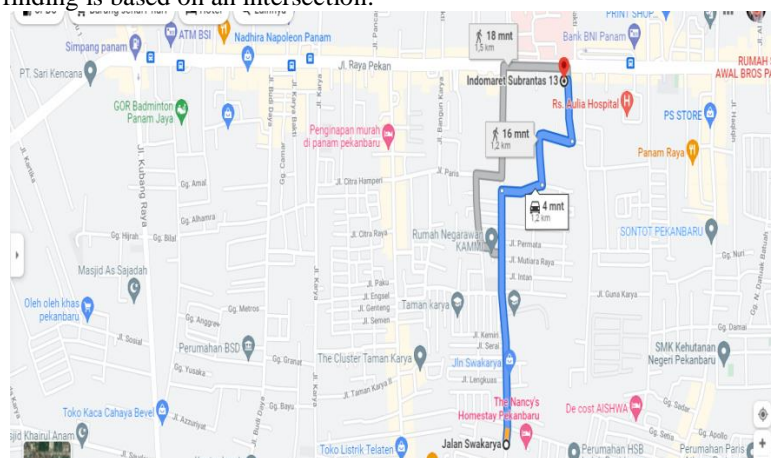


Figure 2. Paths On Google Maps

Google maps data is not a reference in testing because the area that is the subject of research is of course always in the stage of development and change. In Figure 4.19, it can be seen that there are several blue lines which are paths that can be passed to Indomaret Subrantas 13. In the process of determining the shortest route with the A-Star algorithm, the following function formula is used.

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

$f(n)$ = Evaluation function of node n

$g(n)$ = Cost or the distance from the origin node to n

$h(n)$ = The heuristic function of the n node, the heuristic function used is the straight line distance from the n node to the destination.

A to B = 200 M

- B to C = 154 M
- C to D = 129 M
- D to E = 118 M
- E to F = 161 M
- F to H = 16 M
- G to H = 246 M

$g(n)$ is the mileage between nodes indicated by the numbers contained on the sides of the vertices in the graph. The following is an overview of the graph that shows an alternative route from Jl. Swakarya to Indomaret Subrantas 13 as a result of simplification of the depiction from google maps along with the distance. The distance on the graph is obtained from google maps, each of which is calculated based on the distance between nodes.

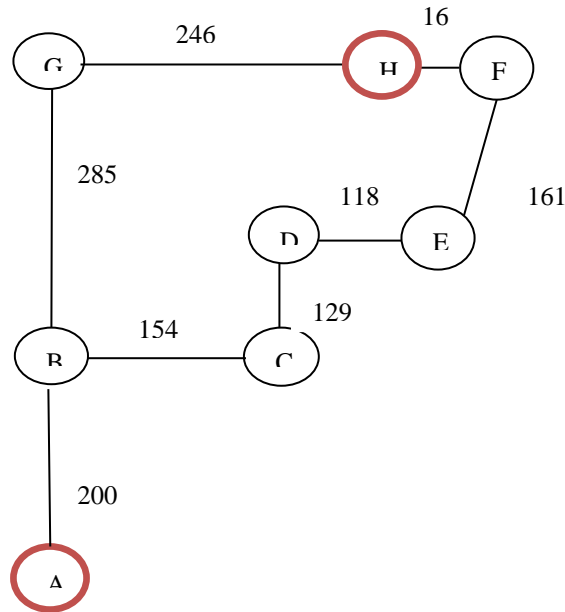


Figure 3 Graph of Alternative Path to Indomaret Subrantas 13

Figure 4.2.0 shows an alternate path graph that has three paths that have been predetermined by the author. As seen in the picture above, point A marked in red is the starting point and the point H marked in red is the destination point.

Table 1. Paths Table

Path	
1	A-B-C-D-E-F-H
2	A-B-G-H

Information:

- A= Jl.swakarya
- B= Jl.Amd
- C= Muslimah Bersaudara’s rent house
- D= Stokis HNI
- E= Ami Kosmetik
- F= Jl. Bina Karya
- G= jl.Soebrantas
- H= Indomaret Soebrantas 13

Then calculating the distance $h(n)$, namely $h(n)$ functions as a heuristic function which is a straight-line distance between nodes which is a benchmark with the distance that the author has obtained from google maps using the measurement distance feature available on google maps. The following can be seen in the straight-line distance table in Table 2.

Table 2. Table of Straight-Line Distance

N	A	B	C	D	E	F	G	H
---	---	---	---	---	---	---	---	---

h(n)	500	375	295	161	162	16	230	0
------	-----	-----	-----	-----	-----	----	-----	---

- (A) = 0+500
- (B) = B to C : 129+295=424
- B to G : 285+230=515
- (C) = C to B : 154+375=529
- C to D : 118+161=279
- (D) = D to C : 129+295=424
- D to E : 161+162=323
- (E) = E to D : 118+161=279
- E to F : 161+16= 177
- (F) = F to E : 161+161=323
- F to H : 16+0=16

After obtaining the entire distance, the next calculation process is called the living node and the expansion node. The living node is the root node. The expansion node is the smallest value of the evaluation function among other living nodes. Here is the calculation process of living nodes and expansive vertices in the A-Star algorithm to determine the shortest route.

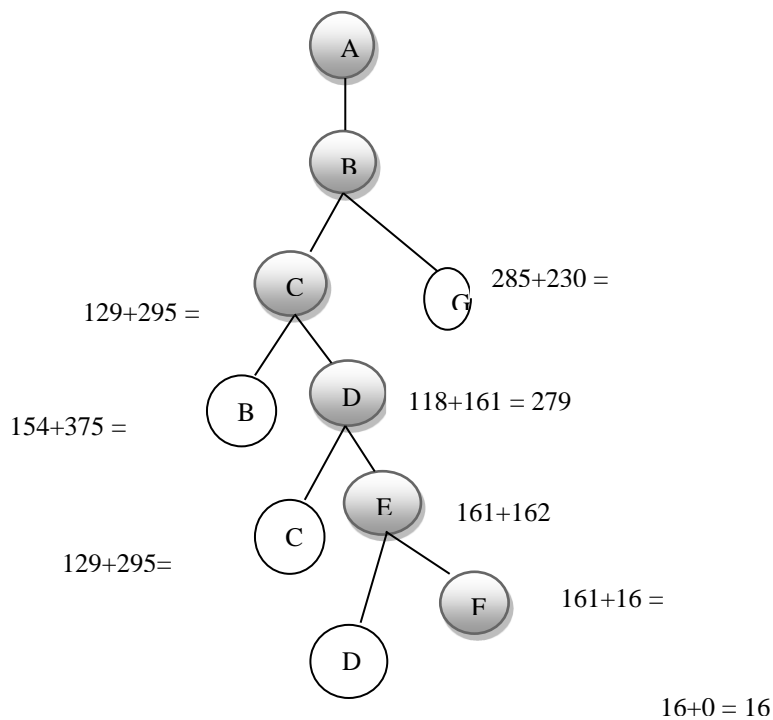


Figure 4. Visualization of Living Nodes and Expansive Vertices

From Figure 4.2.1, it can be seen that the solution to determine the shortest route from the alternative route of Jl. Swakarya to Indomaret Soebrantas 13 has been obtained with the A-B-C-D-E-F-H line.

Table 3 Shortest Route Distance Calculation Results

Street	Route
Jl.swakarya- Jl.Amd	200 m
Jl.Amd - Muslimah Bersaudara’s rent house	154 m
Muslimah Bersaudara’s rent house - Stokis HNI	129 m
Stokis HNI – Ami Kosmetik	118 m
Ami Kosmetik – Jl.Bina Karya	161 m
Jl.Bina Karya – Indomaret Soebrantas	16 m

2.2.4. Implementation System

a. Use Case Diagram

In the use case of this diagram there are several actors who provide input and who receive the output based on the case seen in figure 3.2. in the use case diagram the actors involved are admin and user and each activity can be seen in the following figure.

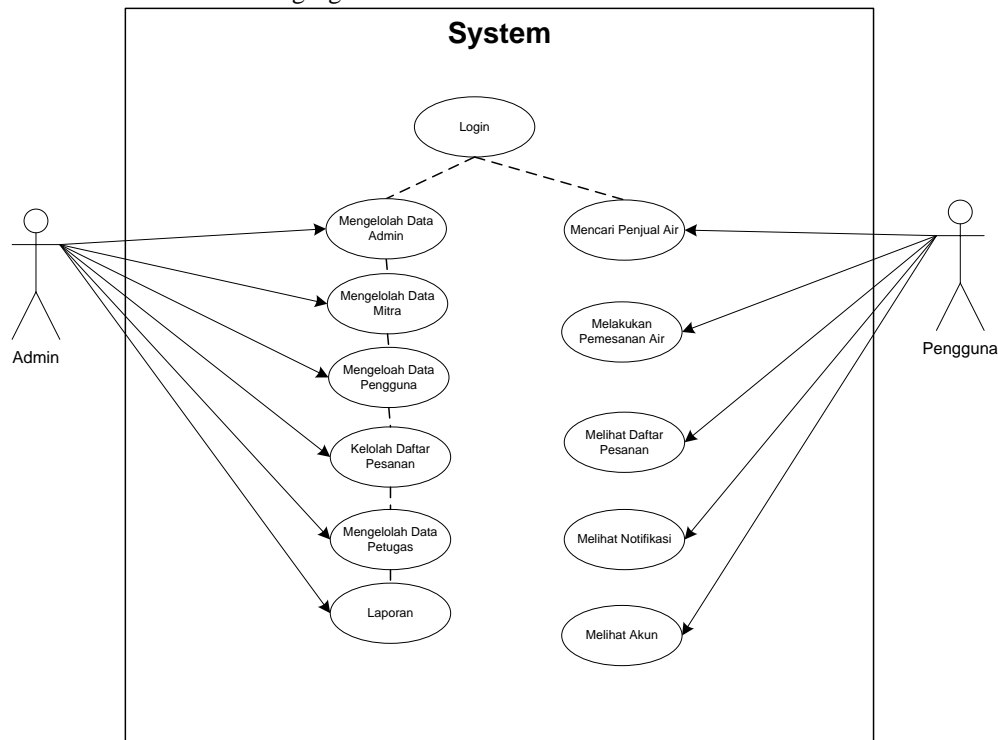


Figure 5. Use Case Diagram

The description of the system use case designed is as follows:

- a. Login: Admin or user login first.
- b. Manage admin data: Admins process admin data.
- c. Managing partner data: Admin processes partner data.
- d. Managing officer data: Admin manages officer data
- e. Manage order data : Admin manages order data
- f. Reports : Admin sees user order report data
- g. Placing water orders: Users place orders for mineral water
- h. View the order list : User sees the order list
- i. View Notifications : User sees notification data
- j. View Account : User sees account data

b. Class Diagram

The Diagram class shows the properties and operations of a class and the constraints contained in the relationships of the object. Here is a picture of the diagram class of the proposed system.

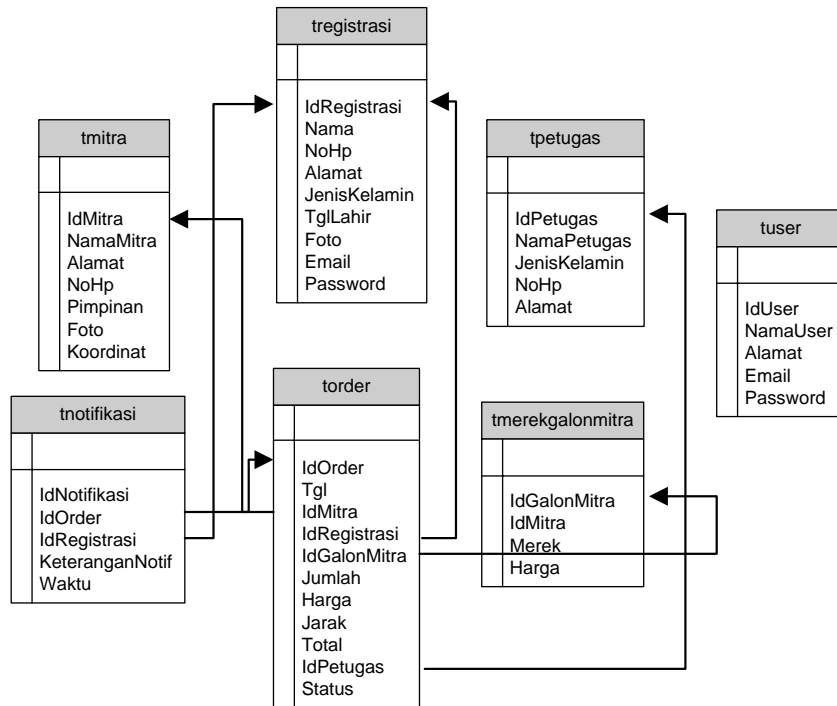


Figure 6. Class Diagram

3. Result and Discussion

3.1. User login page

The user login page is a page where the user of the application to enter the system on the user login display there are 2 buttons, namely the login button and the registration button, the user login display can be seen as shown below:

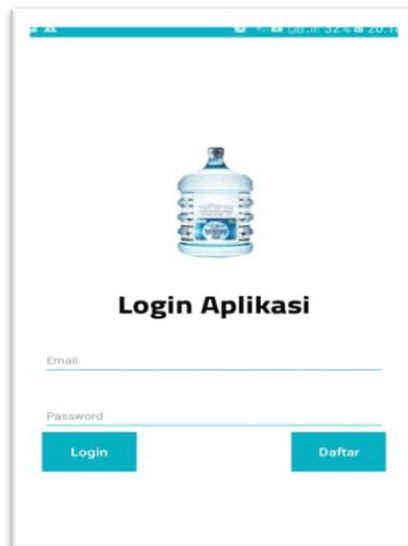


Figure 7. User Login Page

3.2. User Registration Page

The registration page is a page where users register into the application, this registration data will later be able to be used to log into the application, the registration display can be seen as shown below:

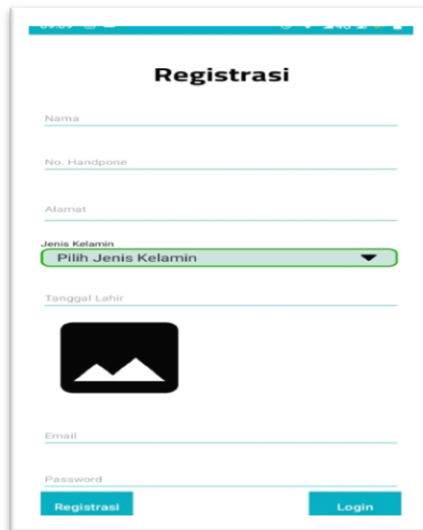


Figure 8. User Registration Page

3.3. User Home Page

The user's main menu page is a page where users can see partner data information and can control all menus in the system, the display can be seen as shown below:

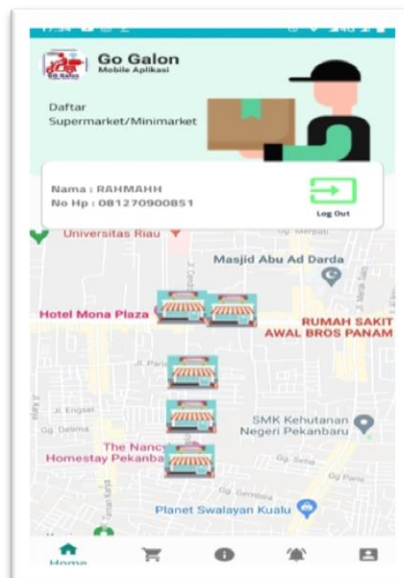


Figure 9. User Home Page

3.4. Account Menu Page

The account menu page is a page where users can see account information, the account menu display can be seen as shown below:



Figure 11. Account Menu Page

3.5. Search menu page

The search menu page is a page to find the data of the nearest partner, the search display can be seen as shown below:



Figure 11. Search menu page

3.6. Notification Page

The notification page is a page where users can see the notification of the order list, the notification display can be seen as shown below:



Figure 12. Notification Page

4. Conclusion

After completing a series of steps to apply the A-Star algorithm (A*) to Go-Gallon applications using the Android programming language kotlin, it can be concluded as follows:

1. Based on the test results of the go-gallon application, conclusions can be drawn, namely that this application is able to find locations where there are gallon water vendors as desired by clicking on the provided list and selecting the desired type of water.
2. It can be used by people who want to order refillable drinking water.
3. To use this app, the user must have an Android smartphone.
4. According to the test results, every function of the app can be done properly.

References

- [1] Ermiyati dan Mulyati. 2019. "Pencarian Rute Terdekat Menuju Rumah Sakit Dikota Bogor Dengan Menggunakan Algoritma A*." *Jurnal Sisfokom (Sistem Informasi dan Komputer)*.
- [2] Daniel Liang, Y., 2020, Introduction to java programming, vol.08, Pearson Education, New Jersey.
- [3] Fitri, A., & Permatasari, N. (2018). Perancangan Sistem Informasi Pengolahan Data Praktek Kerja Lapangan (PKL) Pada Devisi Humas PT. Pegadaian. *Jurnal Intra-Tech*, 2.
- [4] Hohensee, B. (2018). *Getting Started With Android Studio*. Gothenbrug.
- [5] Insani, N. F. (2016). Perancangan Aplikasi Mobile Pencarian Hotel Kota Bandung. *Jurnal Informatika*, 1.
- [6] Marcelina, Dona, and Evi Yulianti. 2020. "Aplikasi Pencarian Rute Terpendek Lokasi Kuliner Khas Palembang Menggunakan Algoritma Euclidean Distance Dan A*(Star)." *Jurnal Sisfokom (Sistem Informasi dan Komputer)*.
- [7] Fernando, Yusra, Muhammad Ativ Mustaqov, and Dyah Ayu Megawaty. 2020. "Penerapan Algoritma A-Star Pada Aplikasi Pencarian Lokasi Fotografi Di Bandar Lampung Berbasis Android." *Jurnal Teknoinfo*.
- [8] Rizky Nugraha, Riva (2019) PEMANFAATAN GOOGLE MAP API UNTUK PEMETAAN LOKASI WISATA DI GARUT BERBASIS ANDROID. Sarjana thesis, Universitas Siliwangi
- [9] Rosa, A. S., & M. Shalahuddin. (2018). *Rekayasa Perangkat Lunak Struktur dan Berorientasi Objek*. In "Rekayasa Perangkat Lunak Terstruktur dan Berorientasi Objek", Edisi Revisi. Informatika
- [10] Wafiqurrahman, Naufal. 2015. "Penerapan Algoritma A*(A-Star) Untuk Penentuan Rute Terpendek Game Pramuka Berbasis Android."
- [11] Widodo, Wahyu, and Imam Ahmad. 2018. "Penerapan Algoritma A Star (A*) Pada Game Petualangan Labirin Berbasis Android." *Khazanah Informatika: Jurnal Ilmu Komputer dan Informatika*.
- [12] Irsyad, Muhammad, and Endang Rasila. 2015. "Aplikasi Pencarian Lokasi Gedung Dan Ruang Universitas Islam Negeri Sultan Syarif Kasim Riau Pada Platform Android Menggunakan Algoritma A-Star (A *)." *Jurnal CoreIT 1(2)*: 90–95.
- [13] Prihandoyo, T. (2018). Inified Modeling Language (UML) Model Untuk Pengembangan Sistem Informasi Akademik Berbasis Web. *Jurnal Informatika: Jurnal Pengembangan IT (JPIT)*, 03(01,) 126-129.
- [14] Habni, H., Jobiliong, & E., Riman, A. (2014, Oktober). Rancang Bangun Alat Pengangkat Tabung (Gallon) Air Minum Collapsible. *Jurnal Ilmiah Teknik Mesin Cylinder*, vol. 1. no. 2. hh. 24-26.
- [15] Suparti, E., & Ria, R. (2017, Februari). Perancangan Ulang Alat Penuang Air Galon Guna Meminimalisasi Beban Pengangkatan Dengan Metode Quality Function Deployment. Paper presentasi pada Seminar Nasional Inovasi Dan Aplikasi Teknologi Di Industri 2017. Malang.
- [16] Anwar, U., Sari, A. P., & Nasution, R. (2017). Perancangan Aplikasi Wisata Kabupaten Lebak Menggunakan Algoritma A * (A-Star) Berbasis Android. *Simposium Nasional Ilmu Pengetahuan Dan Teknologi (SIMNASIPTEK)*.
- [17] Rosita Ayu Nugraheni, Mulyono, Rohmad. 2015. Penerapan Algoritma A* Dalam Penyelesaian Rute Terpendek Pendistribusian Barang. Universitas Negeri Semarang
- [18] Andi, Rumani dkk. 2017. Perbandingan Kompleksitas Algoritma A-Star, FloydWarshall, Viterbi Pada SDN (Software Defined Networking).
- [19] Hernawan, L, et al (2013) , Penerapan Algoritma A* Pada Aplikasi Puzzle. Palembang: Sekolah Tinggi Teknik Musi.
- [20] Musri, et al (2014), Pencarian Jalur Terpendek Pada Snake Game Menggunakan Algoritma A*. Pontianak.
- [21] Boehm, B (1986), A spiral model of software development and enhancement. *ACM SIGSOFT Software Engineering Notes*, ACM, 11(4):14-24.
- [22] Tilawah, H (2011), Penerapan Algoritma A-star (A*) Untuk Menyelesaikan Masalah Maze. Bandung
- [23] Kristanto, A (2004), *Rekayasa Perangkat Lunak (Konsep Dasar)*, Yogyakarta:Gramedia.
- [24] Pamungkas, A, et al (2014), Penerapan Algoritma A* (A star) Pada Game Edukasi The Maze Island Berbasis Android. Palembang: STMIK GI MDP
- [25] Kikik Chomsan Maaruf. 2016. Kecerdasan Buatan Menggunakan Algoritma A Star (A*) Dalam Permainan Ular Tangga (Snake 3D).