Vol. 1 No. 1 Year. 2023.

Designing Healthcare and Pharmaceutical Applications Based on Geographic Information Systems (GIS)

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Abstract* − *Data and information pertaining to health care delivery that have been disclosed at this time will be documented and ultimately used as input to get input, output, and output research processes. Utilizing a mobile device, the provided application can make it easier for users to do location-based searches and access remote healthcare services. Sample data from locations providing health care and other information are required for this application in order to make it simple for the general public to get accurate information. The application presents a list menu of health services based on the database category. The application may display a map of Pekanbaru's as well as coordinate points for every data in the database. This application provides information to the people of Pekanbaru's about health-care facilities, such as pharmacy, clinics, and hospitals. The information and data that will be disseminated will make it easier for users to find locations that match their needs or are close to where they are since they are categorized by proximity to the location. This app provides information on the routes that are being used to go to the locations that have been selected. This application is useful for increasing the availability of health-care information to those who require it.

Key words - Android, GIS, Medical Services

I. PRELIMINARY

The proliferation of mobile phones has created a powerful communication channel for enhancing health information systems. Functional and structural characteristics of mobile phones such as low start-up cost, text messaging, and flexible payment plans, make them attractive to use for contacts with patients in various health care processes. Low acquisition costs, SMS and flexible payment plans make them attractive for contact with patients in various medical processes. Often used to communicate information to patients, it can be used in conjunction with health-related software apps to provide the real-time feedback needed to monitor treatment compliance and effectiveness, it can also act as a data collection tool. Additionally, back-end systems connected to mobile phones can serve as platforms to enable pre-programmed, portable, automated services that can increasingly decentralize healthcare and medical information systems.

Much work is being done today to improve various healthcare processes, both preventive and reactive, using mobile communications. This happens in various ways. Better communication between doctors and patients (e.g., reminder system) Better communication with regional health centers and central hospitals (e.g., local doctors sending pictures for expert analysis), as well as number of patients by providing preventative health information to reduce malnutrition (e.g., by helping people live healthier lives), and by providing better statistics, health care services related to, for example, natural disasters and epidemics. By better planning system interventions and resource allocations.

Many, if not all, of the systems used for the above purposes require backend systems, or will at least perform better if they have such. For instance, reminders to patients about visiting the doctor or taking their medicine must be integrated with a patient record to avoid a huge amount of manual labor. A text messaging (short message service, SMS) system for reporting cases of HIV/AIDS at a local health care center to a central hospital should be integrated with some apps for producing statistics and informing relevant actors about the development; for example, the developments of the number and the nature of cases at different care centers might vary over time that may require redistribution of resources to provide effective care. More generally, to be effective with respect to all stakeholders in health care, data collection systems should be technically integrated with systems for communication and decision making. As there is much health care data around, and many variables involved in making good decisions, medical as well as administrative, spatial, and economic, there is a need for effective data handling, analysis, and presentation. For example, health data from different parts of the country can be displayed in a Geographic Information System (GIS) to provide decision makers with better communication options. You can make the data easier to understand by

using a graphical representation and can be combined with other data representing different regions, such as data related to population, geography, or economy, making it easier to analyze. All these factors may need to be considered in order to optimize the allocation of the country's available health care resources and ensure that effective practices are used across the board.

Therefore, this study addresses both mobile phones, a technology used in healthcare operational processes, and GIS, a technology for decision support in healthcare. This research looks for examples of the integration of two types of technology, and looks for clues on how this integration can be most effectively achieved, based on the assumption that integration is generally low due to the relative newness of the technology. What are your needs and potential benefits?

The purpose of this article is to provide a literature review on the use of mobile technology and GIS in health-related research to improve healthcare delivery. The main topic of the review is the use of mobile technology and GIS to improve healthcare. The research questions underlying this literature review are:

1. What is the geographical distribution of publications on mobile technologies and GIS?
2. How have mobile technologies and GIS been used to improve health care?
3. What were the effects associated with the use of mobile technologies and GIS?

II. RELATED RESEARCH

This This chapter includes the review of related researches and studies which the author has perused to shed light on the topic under study.

1. Foreign Studies

Ngai, E. W., Poon, J. K. L., Suk, F. F. C., & Ng, C. C. In their journal article “Design of an RFID-based healthcare management system using an information system design theory. Information Systems Frontiers” discusses the creation of a health management system using the RFID method. This system is web-based, and features a database system for drug inventory and their patient data.

This study is closely related to the current study because it contains crucial information on how to management healthcare system. The present study aims to create the design model for an application that would be of a higher quality based on their analyzed data.

2. Local Studies

Diputra, B. R. F. In their journal article “Rancang Bangun Aplikasi Pencarian Lokasi Apotek di Kota Bondowoso Memanfaatkan Global Positioning System (GPS) dengan Metode Dijkstra Berbasis Android” discusses the creation of a health service location search application by utilizing the global positioning system using the Dijkstra method. This system is smartphone-based, and has a database system to find the nearest health service from our location.

This study is related to the current study in that it details very well a mobile-based healthcare application that has similar features such as a Global Positioning System. This study aims to further develop this design model. The present study aims to incorporate these findings in order to create an application that will be efficient and effective both design-wise and framework-wise. chapter includes the review of related researches and studies which the author has perused to shed light on the topic under study.

3. Foreign Studies

Andrew Scheman and Solveig Hagen in their journal article “American Contact Dermatitis Society Contact Allergy Management Program App” discussed about the creation of a mobile application dedicated to showing the safe products that someone afflicted with the contact dermatitis disease can consume and featuring a user-friendly interface with the ‘hamburger’ icon. Furthermore, they discussed about the possibilities of such an app being applied to the entire dermatitis disease in general, and not just limited to contact dermatitis.

This study is closely related to the current study for it directly mentions the possibilities of an application specifically dedicated for countermeasures against dermatitis. The present study, much like the journal article, aims to create the design model for such an application. [11]

Dahee Jin, Tae Hoon Yeo, Yoon Lee, and Ji-Tae Choung in their journal article “Qualitative Assessment of Atopic Dermatitis-Related Mobile Applications in Korea” analyzed the currently available mobile applications by searching

the keyword 'atopic dermatitis' in the application markets. They analyzed its quality, its number of downloads, and its relations to the quality of information available regarding the dermatitis disease.

This study is closely related to the current study for it contains crucial information on how to spread information regarding the dermatitis disease to the mass media, and how certain factors and designs raise that percentage by quite a substantial amount. The present study aims to create the design model for an application that would be of a higher quality based on their analyzed data. [12]

4. Local Studies

Heny Ispur Pratiwi and Richard Kamardi in their journal article "Pengembangan Sistem Web Sebagai Diagnosa Dini Penyakit Alergi Kulit Dermatitis Atopik Dengan Metode Forward Chaining" discusses the creation and development of an early diagnosis system for the atopic dermatitis disease using the forward chaining method. The system is web-based, and features a consultation system and a database system for symptoms of atopic dermatitis.

This study is closely related to the current study for it details a very good foundation for the mobile-based application ANTIDERM as it has similar features such as a consultation system and a database system. The present study aims to develop this design model further to include not just atopic dermatitis, but also contact dermatitis and seborrheic dermatitis. [13]

Betty Ayu Rahmaditiya, Tatang Rohana, and Santi Arum Puspita Lestari in their journal article "Implementasi *Forward Chaining* Untuk Mendiagnosis Penyakit Kulit Dermatitis Pada Bayi" discusses yet another mobile application that is aimed at counteracting the dermatitis disease, albeit concerning more about the coding framework process than the design aesthetic itself by utilizing the commonly-used *Forward Chaining* method.

This study is closely related to the current study for it details and supplements the application foundation and the Design Sprint's weakness of lacking in other non-design areas. The present study aims to incorporate these findings in order to create an application that will be efficient and effective both design-wise and framework-wise. [14]

III. RESEARCH METHODS

A. Data Source

The information for this research was gathered using of summaries related to obtaining of the location of the health center, a description of the health center that is available, and a photograph of the health center.

B. Software Development Stages

SDLC stages used in this research consist of:

1. Analyzing the System

Data and information pertaining to health care delivery that have been disclosed at this time will be documented and ultimately used as input to get input, output, and output research processes.

2. System Development

Unified Modeling Language (UML) is used during system analysis to clearly define what can be accessed by users and what can be accessed by administrators. Process modeling, data modeling, and interface modeling are the documents that are being used in this phase.

3. Implementation and Codification

Eclipse is used in the source code of the program as a mobile application language that is used to create an Android app. Use the Google Maps API tool to get detailed location information for each location and to use LBS to find the fastest route from where you are to where you need to be. This will allow you to accomplish your goals. For the database itself, MySQL was used, and a Web administrator was built, so that in the event that any health-related input was compromised, such as location, description, or other data, it could be done so without compromising the integrity of the code within the running Eclipse application.

4. Pending and Implementation

When using the application at this time, the GPS must be active in order to display the data that has already been built. Program testing is done in order to identify any underlying issues that may arise throughout the development process and provide applications that are appropriate for the target system. When a system is declared successful, it moves on to the stage of implementation for the user who is using the application

IV. RESULTS AND DISCUSSION

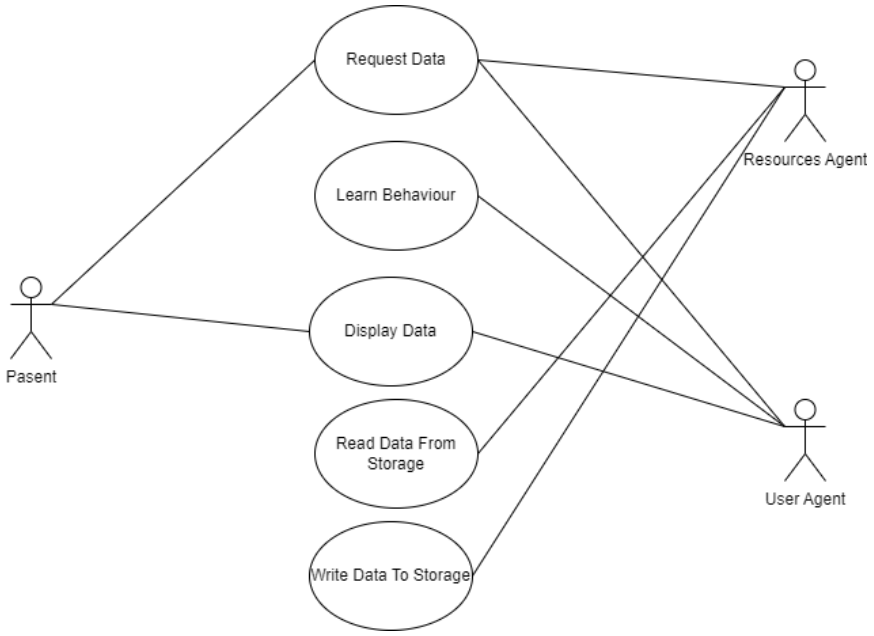
A. Analysis of the current system

Utilizing a mobile device, the provided application can make it easier for users to do location based searches and access remote healthcare services. Sample data from locations providing health care and other information are required for this application in order to make it simple for the general public to get accurate information. Sampel provided data location of healthcare providers that was coordinated with Google's Maps service, and healthcare provider categories were broken down into four types: pharmacy, clinic, and hospital.

B. Designing Use Case Diagrams

Use Case Diagram is a tool used to simulate the behavior of a system that will be created. A use case diagram describes a conversation between a single or more actors and the created system.

Case Study Diagram of the location-based health care system in Kota Pekanbaru is shown in Figure 1 below. It is a comprehensive representation of the system that will be implemented.



Picture 1. Use Case Diagrams

Use Case Diagram from the application of Geographic Information System (GIS) and Location Based Service (LBS) at the location of the health care facility in Kota Pekanbaru's using the Android device shown in Figure 1 above may be explained as follows:

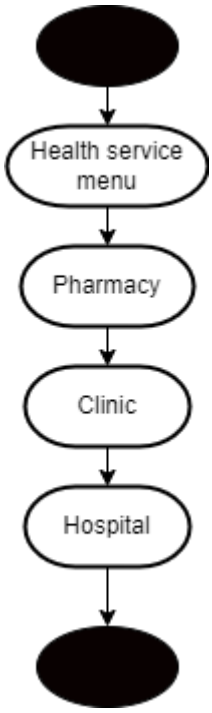
1. Users are those who will use the system.
2. The main menu is the initial display when the application is run.
3. On the select health service menu, the user can choose whether to look for a pharmacy, clinic, or hospital.
4. After the health service menu is selected, the user can choose the closest location based on the distance displayed.
5. Photos, descriptions, distances will be displayed after the user selects a health service.
6. Users can direct the location from where they are to their destination by clicking the map option on the health service display that opens.
7. Users can display a map of the city of Pekanbaru's along with all existing health service locations in the database.
8. Users can call emergency numbers by shortcut in the application.
9. In the admin section, the admin can do the login process and be verified first.
10. After the admin logs in, the admin can manage all data from health services.

C. Designing Activity Diagrams

Activity Diagrams is a diagram that represents the business process workflow and the routine activities inside a process. Activity diagram used in the city of Pekanbaru's location-based health care system is as follows:

1. Activity diagram of health service menu choices.

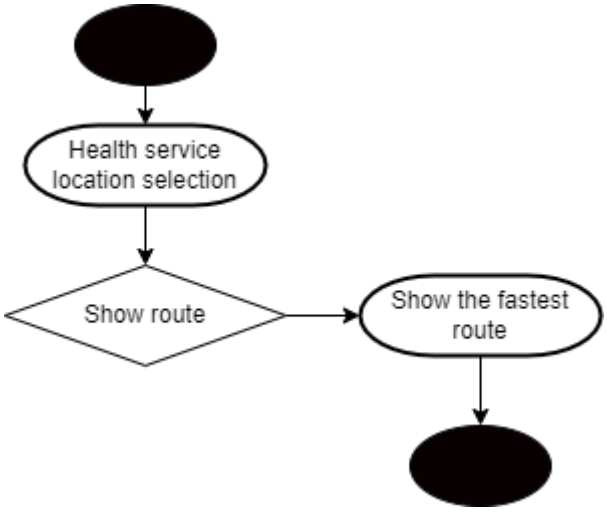
This is an activity diagram for the process of selecting the healthful menu options. The user will navigate to the main menu and then select the health services option. On this menu, categories for available health services, such as pharmacies, clinics, and hospital, will be listed.



Picture 2. Activity diagram of health service menu choices

2. The activity diagram helps to move the location from the beginning to the end goal.

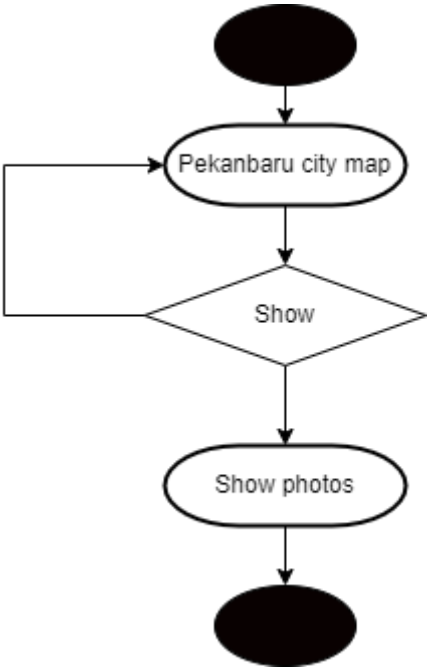
The user of this activity diagram may automatically plan their route. The application can detect fast roads, as shown in the fourth image below.



Picture 3. Activity diagram directs the initial location to the destination

3. The activity diagram displays a map of the city of Pekanbaru

The user can show a map and all the coordinates of health care sites in Pekanbaru city in the activity diagram design from the Pekanbaru's city map menu.

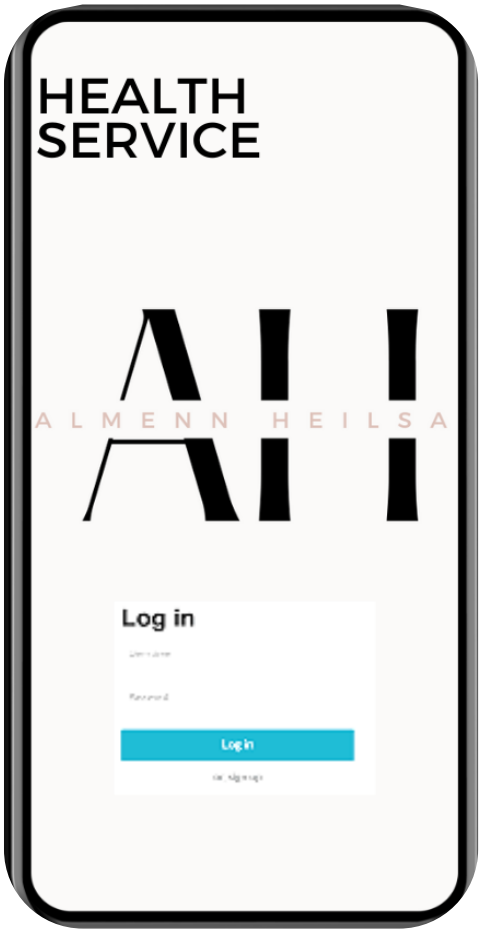


Picture 4. The activity diagram displays a map of the city of Pekanbaru's

D. System Implementation Results

1. Page of the Splash Screen

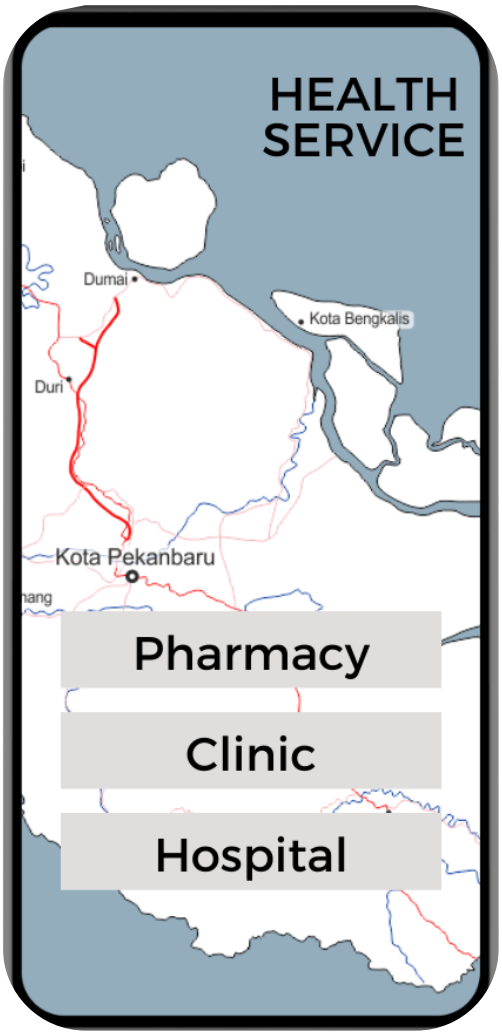
This section is active and appears when a user launches an application that aids in the loading of an application for the first time.



Picture 5. Page of the Splash Screen

2. Page of the Main Menu

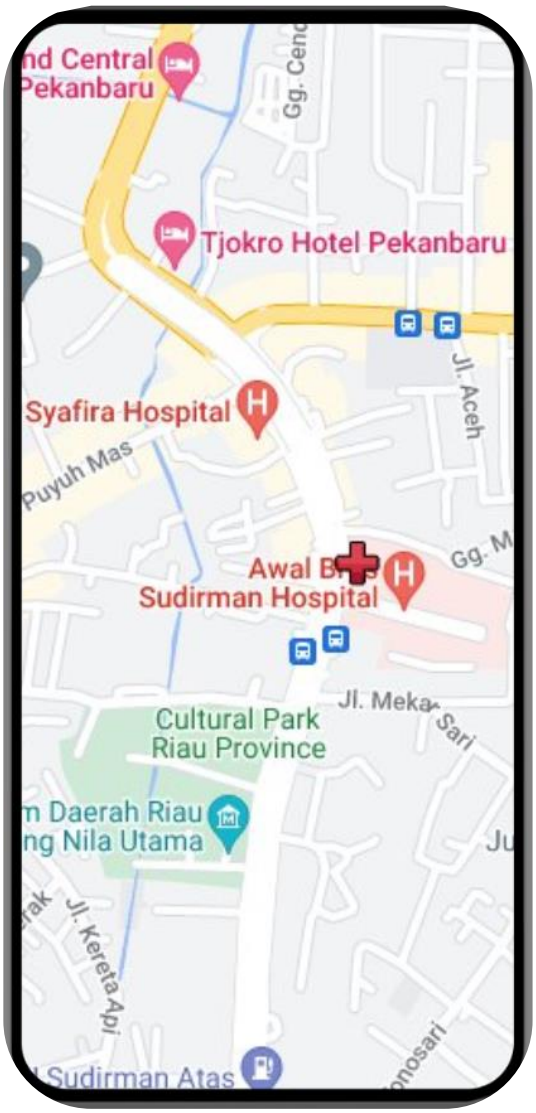
This page will be activated for the first time when the loading process for the splash screen has completed. Then, it will list the categories of health care services, such as pharmacy, clinic, and hospital.



Picture 6. Page of the Main Menu

3. Page with a Map of Pekanbaru

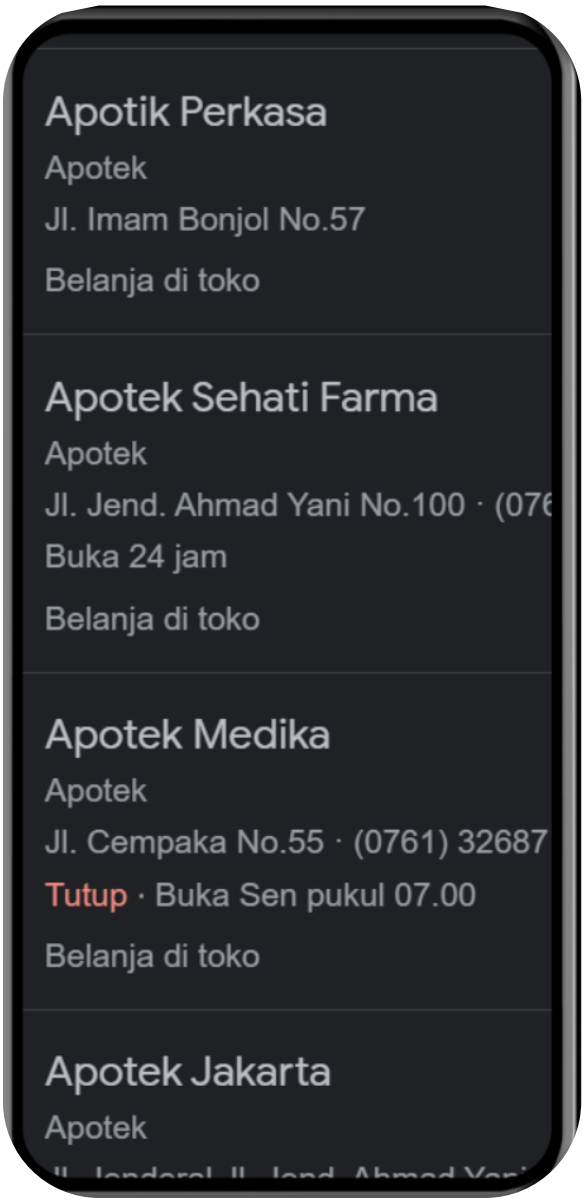
This address is used to provide information about the city of Pekanbaru, as well as all of the locations of health-care coordination data that are available through the app.



Picture 7. Page with a Map of Pekanbaru's

4. Page with a Pharmacy List

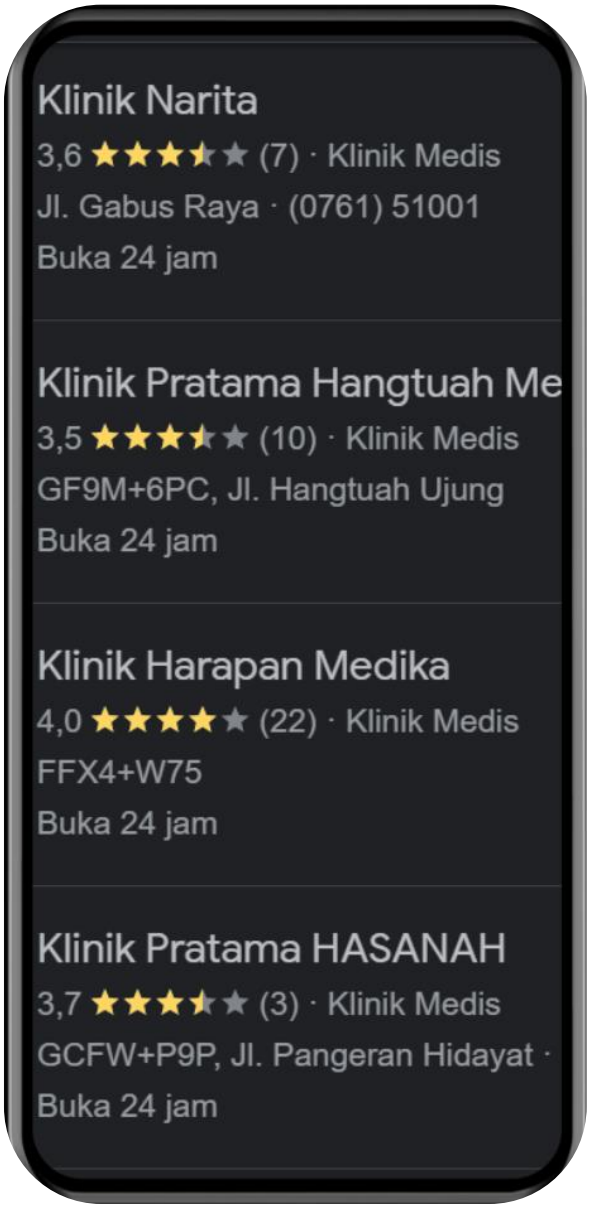
This page will display all pharmaceutical data in the application database, as seen below.



Picture 8. Page with a Pharmacy List

5. Clinic List Page

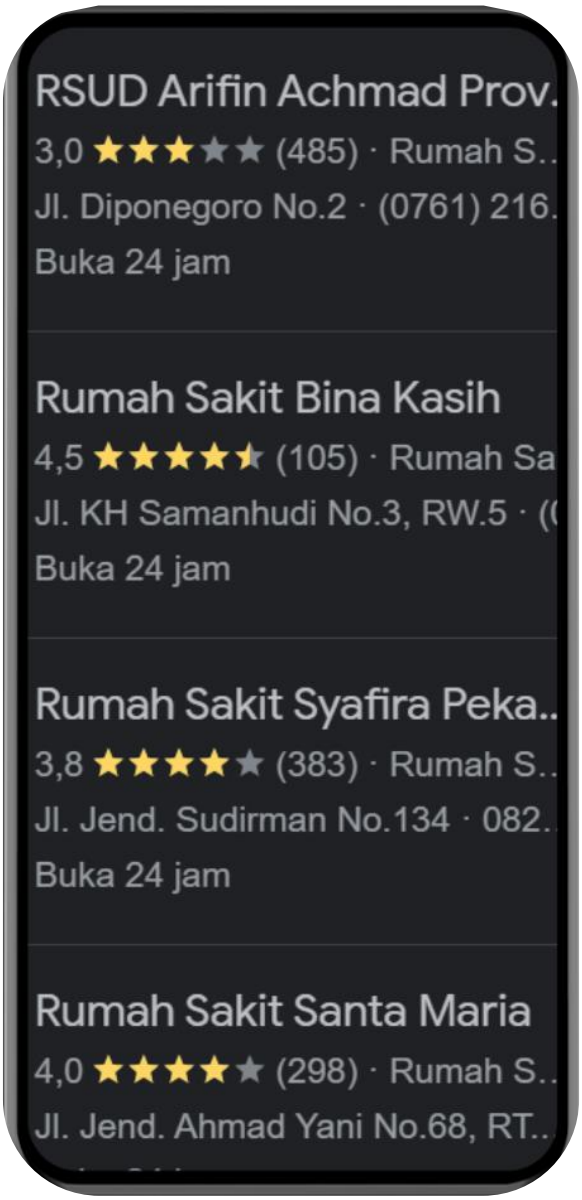
This page will provide access to all clinical data stored in a database, as seen below.



Picture 9. Clinic List Page

6. Page with a Hospital List

This website will upload all of the data from your house that is stored in a database, as seen below.



Picture 10. Page with a Hospital List

E. Testing Technique

The Black Box approach is employed in the outcomes of application testing here by testing the basic operations of the system. The following table 1 shows the results of testing the basic system operations of this Health Service application :

No	Trial Case	Expected Results	The Result Happened	Result

1.	Function test submenu	The application will display a submenu or sliding menu that has been programmed in the application.	The application displays which menus are compatible with which programs developed by the application.	Success
2.	Trying out a menu list service health	The application will provide a service list from the database, allowing you to select a clinic, proper health facility, or hospital category.	The application presents a list menu of health services based on the database category.	Success
3.	Pekanbaru's city map is being tested for display.	The application will provide information on the city of Pekanbaru's as well as all health-care coordination data in the city of Pekanbaru's.	The application may display a map of Pekanbaru's as well as coordinate points for every data in the database.	Success
4.	Testing displays the distance between the user and the destination.	The application provides the quickest path that users can take to get to their destination.	The application presents a path via the final line that users can follow to get to the specified location.	Success

5.	Putting detail function database choices to the test	The application may display all data according to the database system.	All comprehensive info is displayed by the application. what is contained within databases	Success

V. CONCLUSION

The results of this study are as follows:
This application provides information to the people of Pekanbaru's about health-care facilities, such as pharmacy, clinics, and hospitals. The information and data that will be disseminated will make it easier for users to find locations that match their needs or are close to where they are since they are categorized by proximity to the location. This app provides information on the routes that are being used to go to the locations that have been selected. This application is useful for increasing the availability of health-care information to those who require it..

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my teacher *Mr. Debi Setiawan*, who gave me the golden opportunity to do this journal article project, and who have taught me so many new things about the relevant terms. I am extremely grateful to him.

I would also like to thank my friends, who have supported me in finalizing and finishing this project within the limited time available.

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