Design and Build a Pharmacy Location Mapping Information System in Batam City

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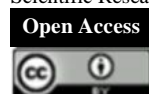
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Abstract

Geographic information systems have been widely applied in the health sector, including to determine the location of medical clinics, midwife clinics, and pharmacies. Currently, in Batam City, there is no mapping-based system that is used to find out the distribution of pharmacy locations, so it is very difficult for the public to get information on the location of pharmacies that are close to their location. Therefore, in this study, an information system for mapping the location of pharmacies in Batam City was made by adopting GIS technology. The study used a descriptive analysis approach and was developed using the waterfall method in software development and UML as a design tool. The system produced in this study is proven to be able to provide pharmacy location information and assist admins in managing pharmacy location data.

Keywords: Geographic Information System, Pharmacy, PHP, MySQL, UML

1. Introduction

1.1 Sub Introduction

Geographic information system (GIS) is one of the results of advances in information technology that can help humans to find the location or direction of the destination they want to visit(Sari et al., 2021). GIS itself can be defined as a computer-based system that is useful for processing and displaying data in the form of maps(Rodonuwu et al., 2020).

So that GIS can be used to assist users in determining a particular location. GIS is experiencing rapid development and can be applied in various fields including the health sector(Ferdiansyah, 2017). Several studies on the use of GIS for the health sector, for example, were carried out byMooniarsih and Imansyah (2020)who conducted research on the use of GIS applications to assist the Health Office in analyzing data to monitor the nutritional development of children under five. Ady Aryanto and Marini Mandenni, (2020)conducted research on the application of GIS for mapping Puskesmas in Tabanan Regency, Bali.

In addition, the application of GIS in other health fields is to assist the community in finding the location of pharmacies in the vicinity(Hernando and Roestam, 2017). Apotek is an absorption language taken from the Dutch language: Apotheek which means a place to mix and sell drugs according to a doctor's prescription. In addition, pharmacies also sell other medical devices(Lahia et al., 2021). Pharmacies are also a place for pharmacists to practice the pharmacy profession and also act as retailers(Ramadhani et al., 2020).

According toMauladi et al., (2017) use of GIS can be used to help the public obtain information on the locations of pharmacies in the form of maps. With GIS, people can find the nearest pharmacy location easily(Hernando and Roestam, 2017).

Pharmacy is a public health service that allows people to get and buy medicines. Medicines can be obtained quickly and easily if the pharmacy is close to the local location. However, information about the existence of pharmacies in general, is not widely known, and the general public is difficult to find the location of the nearest pharmacy when looking for drugs prescribed by doctors.

Information on pharmacies that are open 24 hours in the city of Batam is still very limited. With limited information about these pharmacies, you may not be able to get the medicine you need quickly. So it is necessary to have a computerized system that can assist the public in obtaining information on the location of pharmacies that open 24-hour services in Batam City.

Therefore, in this study, we will design a geographic information system for pharmacies in the city of Batam, with the aim of helping people in the city of Batam in obtaining information about the exact location and coordinates of pharmacies, making it easier for people to buy drugs or other medical equipment.

2. Literature Studies

Previous research on the application of GIS technology to determine the distribution of pharmacies in Banyumas Regency resulted in a GIS application that can provide a visualization of the distance and distribution of pharmacies in Banyumas Regency, besides that the system also provides information on community visits to pharmacies and other health facilities (Manan et al., 2020).

Nurul Hakim and Cahyana, (2016)conducted research on the application of GIS in helping to obtain information about health and social facilities in Garut City. The results of his research can help and facilitate the community in finding health facilities that are displayed in full with a location map.

Other research was conducted by Nalendra et al., (2019)who conducts research for mapping maternal and child health using GIS. The results of the study provide convenience for the health department in helping related parties to take policies that can reduce the risk of maternal and child mortality.

Based on previous research studies as described above, there are several similarities between previous research and the current research topic. Where GIS technology has been used in helping the health sector to provide mapping-based information services and make it easier for the public to find health services and pharmacies according to the map displayed using GIS technology. In addition, GIS technology can also be used by the government and related parties to help process information that will be used as a basis or material for decision making.

2.1. Geographical Information Systems (GIS)

Geographic Information System (GIS) is one of the results of the development of information technology that is used to manage, capture, store, display and analyze geographic-based data.(Apata et al., 2019). GIS is a system that works, and displays data of spatial or coordinated type(Saputra et al., 2018).

According to Prhasta (2002) inMooniarsih and Imansyah (2020)explained that GIS is a picture of the real world that is displayed on a computer device such as a map in general which has 4 main components, namely: 1) Hardware; 2) Software; 3) Geographical Data and Information; 4) Human Resources/Management

2.2. Google Maps

Google Maps is part of a service created by Google to display digitally based maps. Google Maps uses digital image technology to display objects on the earth's surface directly (Rahayu, 2018). How to use Google Maps requires a browser application for this type of web-based application but it can also use a smartphone for mobile-based applications. Google Maps is open source which allows users to participate in the development of Google Maps (Saputra et al., 2018)

2.3. Database

A database can be defined as a collection of related data that is stored on hardware and managed using a database management system (DBMS) application.Hidayat and Safarudin (2018). According to Reksoatmojo (2018) inHidayat (2021)explained that the use of DBMS helps users in the process of manipulating data in the database such as creating, reading, changing and storing data in the database easily.

2.4. Unified Modeling Language (UML)

According to Rosa and Salahuddin (2016) in(Hidayat et al., 2020)Unified Modeling Language (UML) is a tool used to create object-based system modeling. UML is used to describe an information system that will be developed(Hidayat, 2020). According to Fowler (2004) in (Hidayat, 2018)explained that UML is a family of graphic notations that help explain the design of the system to be developed. This tool is used to explain in detail everything needed by the system (Haviluddin, 2011) in (Hidayat, 2021)

3. Method

This research uses descriptive research method. Where in this descriptive study aims to explain a phenomenon or event that occurs in a scientific method(Wijaya, 2017). While the system development method uses the waterfall method and the design model uses UML.

3.1. Research sites

This research was conducted in Batam City which is the largest city in the Riau Islands province of Indonesia. The Batam City area consists of Batam Island, Lempang Island, Galang Island, and other small islands in the Singapore Strait and the Malacca Strait. The islands of Batam, Lempang and Galang are connected by the Balerang Bridge. According to the Batam City Population Registration Service, in 2015 the population of Batam reached 1,037,187 inhabitants. Batam is part of the Batam-Bintan-Karimun Special Free Trade Area (BBK). Batam is a city that is very strategically located. The city is not only on international shipping lanes, but also quite close to direct borders with Singapore and Malaysia. As a planned city, Batam is one of the fastest growing cities in Indonesia.

Fig 1. Batam City Map (arcgis.com)

The number of pharmacies in Batam City based on data from the Batam City Central Statistics Agency is 36 pharmacies in 2021 with the following distribution:

Table 1. Pharmacy Data in Batam City

Kecamatan	Apotek		
	2019	2020	2021
Belakang Padang	-	-	-
Bulang	-	1	1
Galang	-	-	-
Sungai Beduk	3	3	2
Sagulung	4	4	4
Nongsa	3	3	3
Batam Kota	6	6	6
Sekupang	7	6	5
Batu Aji	4	4	4
Lubuk Baja	4	4	4
Batu Ampar	3	3	3
Bengkong	4	4	4
Kota Batam	**38**	**38**	**36**

3.2. Research Stages

The stages of this research adopt the concept of Software Development Life Cycle and are developed as can be seen in Figure 2. Where the initial stage in this research is conducting a literature study.

This is done to find information, data or related research in research. The data needed in this study are:

1. Data on the Number of Pharmacies in Batam City;
2. Pharmacy location information;
3. Information about GIS;
4. Utilization of Google Maps.

This literature survey forms the basis of this research. The process of taking or collecting data in this study was carried out using various existing media tools. Pharmacy location data is obtained using the information available on the Google Maps platform.

After conducting a literature survey, the next step is to collect existing data and formulate the system requirements to be built first. After the system requirements have been determined, the next step is to analyze the system to be built. Then proceed with designing the system you are building. The design is done by creating a system design field in UML and designing the user interface (UI) and user experience (UX).
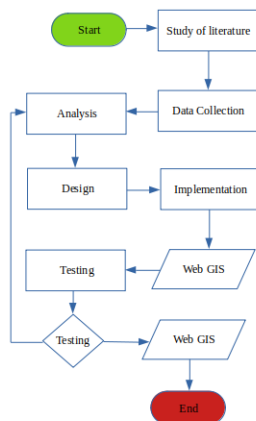

Fig 2. Stages of Research

After the design is made, the next step is to implement or create a computerized mapping system. The development of a web-based pharmacy mapping information system is based on the use of map images on Google Maps, so every pharmacy in Batam City requires Google Maps data which includes longitude and latitude. After the system is built, the system is tested. If there are still errors, the system analysis is re-evaluated and the next process is system redesign and improvement. However, if the created system shows no errors during testing or is declared ready for use, the process is declared complete and released. Each step is carried out continuously and intertwined into a unified whole in this research. To facilitate this research, several tools or software were used to simplify the research process, such as laptops/PCs, Ms. Worte, MS. Visio, Visual Studio Code, XAMPP, Google Maps, and Google Chrome.

4. Result and Discussion

4.1. System Design

System design is the next stage in the systems development life cycle. In this phase, you will use various tools to design a system model that describes an existing system or a new system that is logically developed. Functional processing and data requests are performed by the system using use case diagrams, activity diagrams, sequence diagrams, and class diagrams.
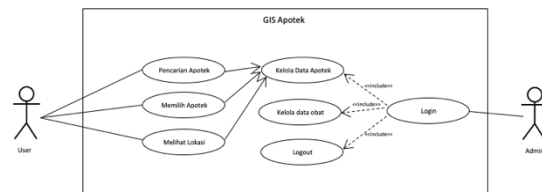
4.2. Use Case

Fig 3. Use Case Diagram

Based on Figure 3 which shows the use case description, it can be seen that there are two groups of users, namely users and admins. General users will be included in the user category while users who are tasked with managing data will be categorized as admins. There are two types of services that can be accessed by users, namely searching and viewing pharmacy data. With this information, it is hoped that the user will get the necessary information about the details of the pharmacy info and the location of the nearest pharmacy from its place. The data accessed by the user is taken based on the data that has been entered by the admin user first.

Meanwhile, the admin user in order to be able to manage data must first validate the login. So the admin must enter the username and password first, then the system will validate the data. If the validation results fail, then the admin will get a failed or error message. If the validation is successful, the system will open a dashboard page that displays the pharmacy data processing menu. There are several menus in the pharmacy data management, including the process of creating, viewing, changing, and

deleting data related to the pharmacy, location data for pharmacies, and information data related to or required by pharmacies

Only users who have logged in can access the pharmacy data management page, if they don't log in, they won't be able to. After the data management process is completed by the admin, then the admin can exit the system by logging out first. This needs to be done to maintain the security of the system so that it is not misused by people who do not have access to the system.

4.3. Activity Diagrams

An activity Diagram is a visual form that describes the activities carried out by users and systems. Figure 4 will show an activity Diagram for finding pharmacy locations. This activity describes the steps taken by the user in searching for the location of the pharmacy, then the system responds and sends data as needed by the user.
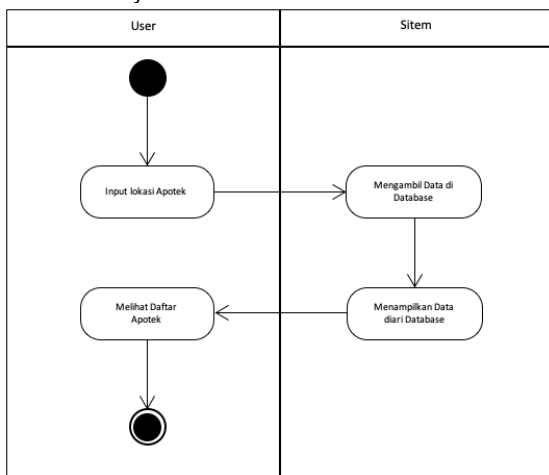

Fig 4. Activity Diagram Search

4.4. Sequence Diagrams

Sequence Diagrams depict interactions between objects (including users, views/shapes) in and around the system in terms of messages plotted over time. Sequence Diagram consists of a vertical dimension (time) and a horizontal dimension (related objects). Sequence Diagrams are often used to describe a scenario or a series of steps that are executed in response to an event to produce a specific result.

Based on activity triggers, processes and changes occurring within, and resulting results. Sequence Diagrams are specifically related to use case diagrams and show step-by-step what should happen to produce something in a use case.

This sequence diagram will show a series of relationships that occur in the system, both between actors and with objects and object classes when the user or actor wants to manage pharmacy data.
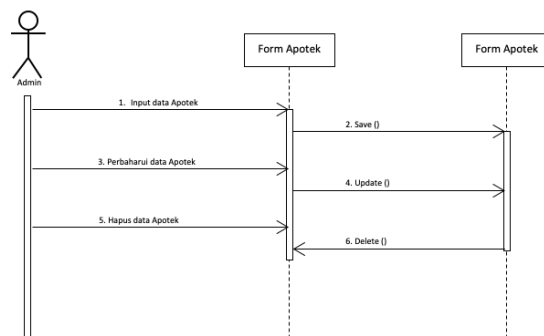

Fig 5. Pharmacy Sequence Diagram

4.5. Implementation

The implementation stage is the stage for implementing the system by carrying out the coding process. This stage will realize the design that was previously made.

1. Login Page
To manage pharmacy data, users are required to login first. This login process is used to ensure that the user who will perform data management is a legitimate user and is given full authority to perform data management. In this study, the user who has the authority to perform data processing is the admin.
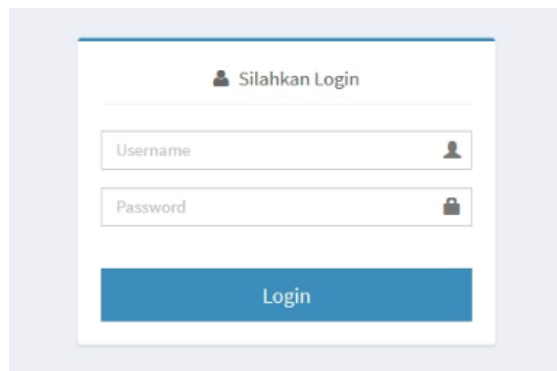

Fig 6. Login Page

In the login process, the admin will be asked to enter the correct username and password, then the system will verify by comparing the data in the database. If the login is successful, the dashboard page will appear.

2. Dashboard Page
After the admin logs in and the login validation process is successful, the dashboard page will appear. On the dashboard page there are several menus that the admin can choose to enter data related to pharmacy data. Admin can also add pharmacy location data or other data related to the pharmacy information. The dashboard page display can be seen in the image below.
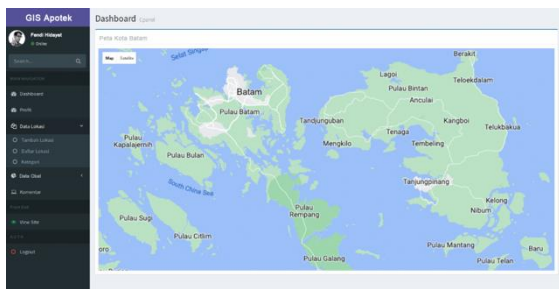
Fig 7. Dashboard page

3. Pharmacy Location Page

General users can search for pharmacy locations and other information by accessing the provided system. In general, information about all pharmacies in Batam City will be displayed. Furthermore, the user can select or search for a pharmacy that is close to the user's location. The following is an image of mapping-based pharmacy location information.
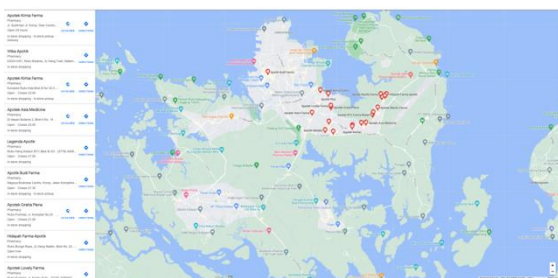

Fig 8. Pharmacy Mapping

5. Conclusion

The results of this study can be concluded that the application of GIS technology to provide information on the location of pharmacies in Batam City based on mapping using a web application can be applied and has a positive impact on making it easier for people to find the nearest pharmacy location. Mapping-based information makes it easier for people to find locations according to precise coordinates so that it will make it easier for people to find the location of the nearest pharmacy. The system developed utilizes Google Maps spatial maps and the data used is stored using the MySql database. To display data on the system, using the PHP programming language.

This system still needs a lot of development in order to have more complete features and requires massive socialization so that people can use and utilize it according to their needs.

6. Acknowledgments

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