WebGIS Distribution of Boarding House Locations (Case Study: Around Politeknik Negeri Batam Campus)

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Abstract. Politeknik Negeri Batam is the only public university in Batam City, Riau Islands Province. By utilizing webGIS technology the purpose of this research is to produce a webGIS for the distribution of boarding house locations that can be accessed via the internet. WebGIS can display information that is equipped with the location of the boarding house and the route of the trip. Making webGIS using data collection methods, data processing, results, and analysis with Liket's method by utilizing Leaflet JavaScript Library technology. While the usability test from several 40 respondents obtained the results of usability testers with an average answer score of MI < X MI + 1.5 SDI, namely 25.5 < 30.7 32.7495, which means that the average answer score is in the "decent" category. it can be said that the webGIS application for the distribution of the location of this boarding house is included in the "appropriate" category.

Keywords: Boarding house, student, webGIS.

1 Introduction

Students are people who are pursuing higher education and seeking knowledge at universities, both public and private. The figure is a student who is expected to have a dynamic nuance and scientific attitude in seeing things based on objective, systematic and rational reality and will become intellectual candidates and intelligent in thinking in planning actions.

A boarding house is a place for lodging services or residential homes that provide rooms for residence. The boarding house is designed to meet the needs of temporary accommodation with the target audience of students and students coming from outside the city or the area. Boarding houses are also the target of being occupied by the general public who do not have a private house and want a location close to the location of their activities. Therefore, the function of the boarding house is as follows:

1. As a means of temporary residence for students who generally come from outside the region during their study period.

2. As a place for students' personality formation to be more independent, disciplined, and responsible.

3. As a place to interact among other students and have social relations with the surrounding environment.

As a means of information, GIS is a computer-based system that can handle geographically referenced data, namely data entry, and data management [6]. WebGIS has a very important role in facilitating the determination of the location of the closest boarding house from campus. The boarding house is a promising business, especially if the boarding house is located in a campus environment because many students come from outside the city or the area. The most important thing in determining whether or not a boarding house is feasible is the location and available facilities that determine the price. The strategic location is usually in the campus environment.

Based on a research questionnaire with Politeknik Negeri Batam students as respondents to the information needs of boarding houses. Barriers that occur to some students include the difficulty of information on boarding houses around campus because they require vehicle access to find them, cannot find information via Google Maps, do not know many people to ask about the location of boarding houses, take time to find boarding houses, and as new people came in Batam City, a little difficulty in getting to know the area.

The role of the community in the need for boarding houses is very important because students who live far away will study for a long time and need a place to live close to campus. To find information, you have to bother looking in various print media, seeing the words "Accept Boarding" which are affixed to the front of the boarding house owner's house, or asking people who know without knowing what the boarding house will be like and what the conditions are [10].

Public services that provide in the form of a web GIS the location of the distribution of boarding houses are very helpful in providing information on boarding houses to be more effective and efficient. By using webGIS technology, you can easily present spatial data that can be accessed online without using GIS software and display a map of the distribution of boarding houses around the Politeknik Negeri Batam campus which is equipped with a route to the location of the boarding house and presented on a website.

This study aims to design and build a geographic information system regarding the information on boarding places, especially at the Politeknik Negeri Batam with a radius of 1.5 km from the campus point by using the web to provide integrated information from spatial data and non-spatial data. WebGIS contains a map of the distribution of the location of the boarding house that can be accessed online via an internet browser. The boarding house object that will be displayed is not only the address of the location and facilities but also equipped with a route. With this webGIS, it is hoped that it can provide information on the distribution map of the location of the boarding house to Politeknik Negeri Batam students who come from outside the city or the region.

In recent years, many webGIS methods have been developed in the boarding house sector, so many studies can be used as references in this research. Research conducted by Laily by processing the potential applications of geospatial technology which is used as a web-based boarding house design to facilitate the search for boarding houses in Batam City. WebGIS-based information source by exploring boarding house data information. This research produces a dynamic webGIS that allows customers to view information on vacant rooms and owners can add rooms and make reports via mobile phones directly. Concerning the previous research, this research was made by providing a geographic information system at the location of the boarding house that serves as a route to that location by utilizing the Leaflet Routing Machine.

2 Research Method

2.1. Data and Location

The location of this research point is around the Politeknik Negeri Batam campus at a position of 1° 7'7.126"N and 104° 2'54,463"E. The farthest distance radius of 1.5 km from the Politeknik Negeri Batam campus is a benchmark for distance-taking points.
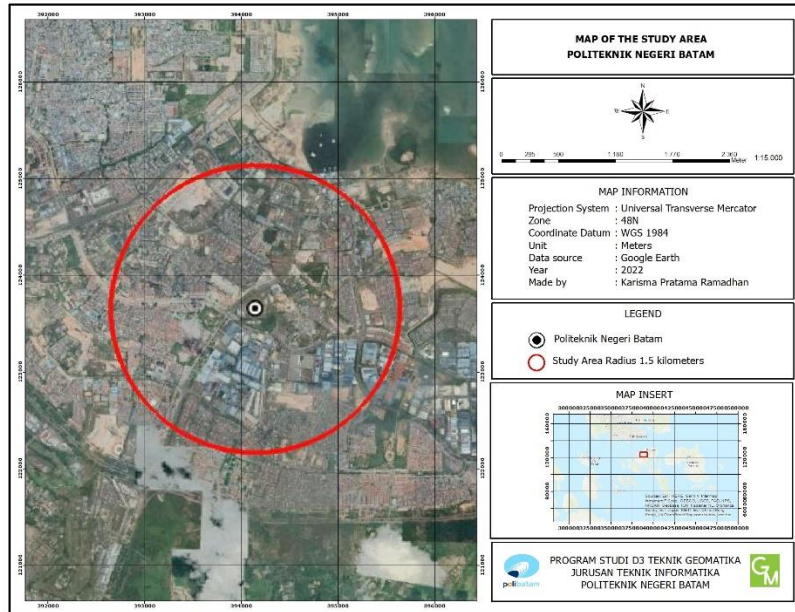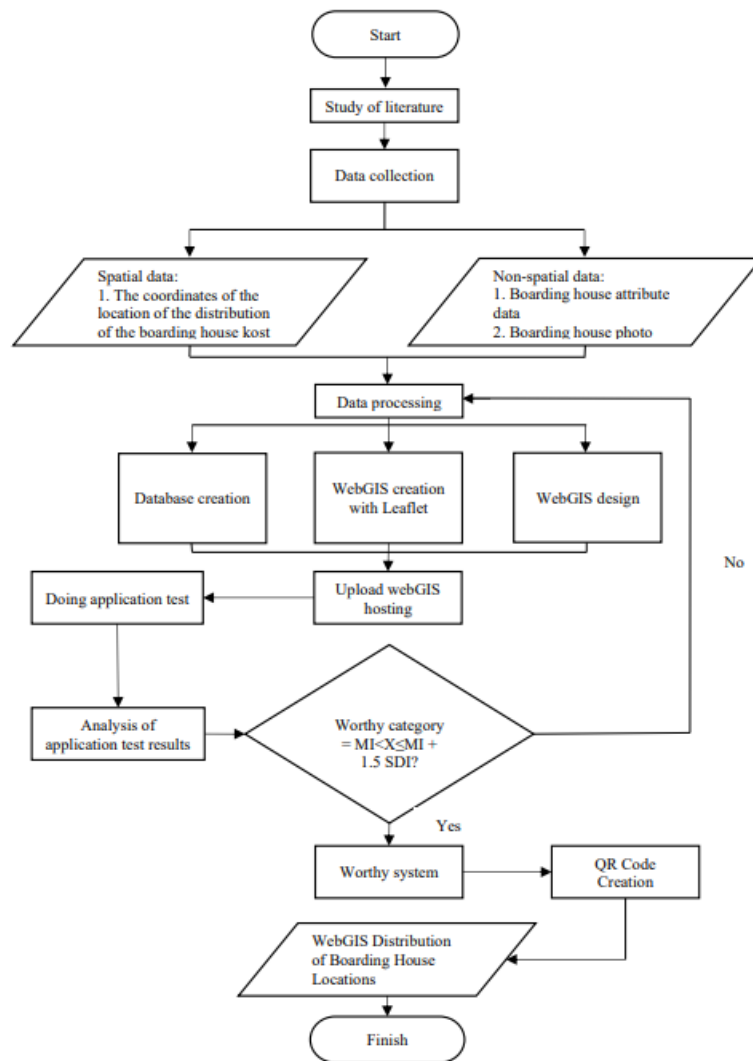

Fig. 1. Research location.

2.2. Methodology

Fig. 2. Research Flowchart.

This research consists of 4 stages, namely the preparation stage, the data collection stage, the data processing stage, and the results and analysis stage. A complete description of the stages of this research can be seen in fig. 2. In the preparation stage, a literature study is carried out by studying books, journals, or other references related to research identification and problem formulation. According to Desti that at this stage of data collection several things must be done in building this system, including [2],

1. Observation (Observation) A method of collecting data is carried out by holding records by observing directly the object under study. At this stage, the researcher observes directly the

process of someone who wants to find a boarding house. The use of this method provides an understanding of the suitability of the application made for the user.

2. Interview (Interview) This method is a data collection that is carried out directly or asking questions to the informant directly on the object being reviewed, namely boarding children and people who often travel so that they get accurate data.

3. Literature study (literature) This method is to obtain theoretical concepts by analyzing data in the literature and other readings that can assist in problem-solving.

The second stage is data collection, divided into spatial and non-spatial data. Spatial data in the form of coordinates of the location of the distribution of the boarding house. Coordinate point data was collected through a field survey. The target of this research is to get the location of the distribution of boarding house locations around the Politeknik Negeri Batam campus. Then non-spatial data in the form of information data such as addresses, facilities, telephone numbers, prices, and photos of boarding houses.

The third stage is data processing, at this stage, the data that has been collected is then entered into Excel. Then do spatial data processing and database creation. Perform system design in the form of use case diagrams to facilitate the creation of webGIS applications. Then make a webGIS which will be explained in detail in the discussion of data processing. So from these stages, the exchange process and data flow become dynamic and efficient. When updating or adding data that is connected to the MySQL database at localhost/PHPMyAdmin, later when the webGIS page is displayed, the data will automatically be updated according to what is in the database. Website creation is done using several software, namely PhpMyAdmin, XAMPP, Leaflet JavaScript Library, and Visual Studio Code.

The fourth or final stage is the results and analysis, in this stage, an application test is carried out with a functionality test and a usability test for the distribution of the boarding house webGIS. To find out the expert opinion on the developed application, a questionnaire was given and processed using a Likert scale. The Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of people about social phenomena [7].

In the functionality tester, the webGIS is tested by using continuous data between one use case (function/process) from beginning to end. User Acceptance Testing (UAT) is a verification process that the solution made in the system is suitable for the user. This process is different from testing the system (making sure the software doesn't crash and conforms to the user's request documents), but rather ensuring that the solution in the system will work for the user i.e., testing that the user accepts the solution in the system.

While at the usability testing stage, an online questionnaire was used with a target of 40 respondents from Politeknik Negeri Batam students. The results of the usability test will determine whether this webGIS is to make it or not. Explains that usability testing is one of the benchmarks for user experience interactivity related to user interfaces such as a website or software in the form of an application [8].

3 Result and Discussion
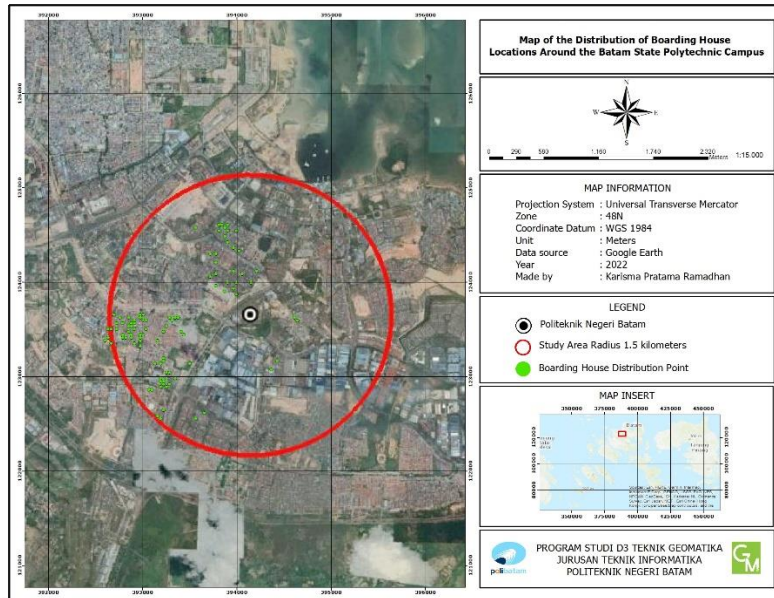
3.1. Distribution of Boarding House Locations

Fig. 3. Map of the distribution of boarding house locations.

The distribution of the coordinates of the boarding house occurs in residential areas, government offices, and industrial areas. In a field survey with a study area of 1.5 km from the Politeknik Negeri Batam campus as a distance taking point, there are 112 points of distribution of boarding house locations. The boarding house data is divided into 3 categories, namely male boarding houses, female boarding houses, and male / female boarding houses. The map of the distribution of the location of the boarding house is the result of input latitude and longitude coordinates. The distribution area includes Greenland Housing, Citra Batam Housing, Alexandria Business Center Shophouse, Center Park Housing, Golden Land Housing, Griya Buana Indah Housing, Anggrek Sari Housing, Taman Marchelia Housing, Taman Sejati Housing, Clara Lestari Lot, Center Point Housing, Shophouse Complex Duta Mas, and Duta Mas Housing.

3.2. Data processing

A graphic depiction of the possibility of user interaction with the system is needed in starting the creation of a system or application. In this case, it is a way to summarize the details of the system and users in the system and then analyze the functional requirements of the system that will be made using use case diagrams. A use case diagram is a description of how someone who uses the process or system will achieve a goal. The use case is an abstraction of the interaction between the system and actors [8]. Use cases usually consist of three basic elements that make up a use case, namely actors, systems, and goals.

Users are given access to registration, login, add boarding house data, access boarding house data and send messages to the admin. Users can choose boarding house information as well as the route to the boarding house. Equipped with access to contact the boarding house owner by

linking the link and message to the admin. Registration and login features for users to register or add boarding house data on home ownership and admins can edit, delete, and view messages contained in the application.
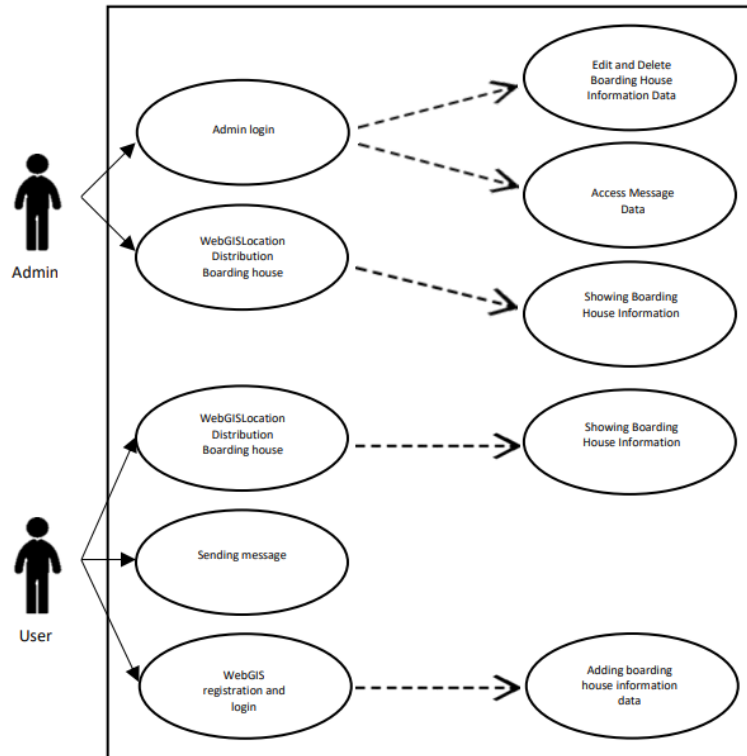

Fig. 4. Use Case.

ERD uses symbols or objects that are composed of three components, namely entities, attributes, and relationships, and each symbol has a relationship with one another [3]. Fig. 5 is a description of the Entity Relationship Diagram (ERD) provided by the researcher in the boarding house information system where this ERD description has 3 main entities, namely the user entity, the boarding house entity, and the message entity. Each entity has several fields, among others, the user entity has an id, username, password, and name field. The boarding house entity has fields of id, address, category, latitude, longitude, facilities, tel., price, and area. The message entity has a name, email, subject, and k_message fields. The relation scheme that describes the relationship between tables can be seen in the ERD in the following figure.
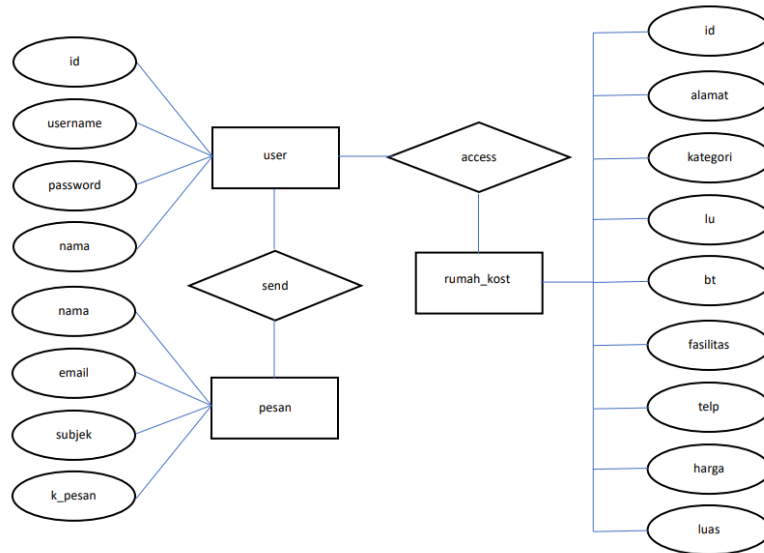
Fig. 5. Entity Relationship Diagram.

3.3. WebGIS Creation

This stage will display the website along with pieces of program scripts to display website pages. The functions.php feature in the file defines function triggers, bindings, and other configuration settings. Each function has one and only one trigger. The runtime uses this configuration file to define events to monitor and how to pass data into and return data from function execution.

The script displays the base map as a base map which is the main view of webGIS. The base map display is focused on the Politeknik Negeri Batam area by entering the coordinates in the script using the JavaScript Leaflet Library as follows:

```
var map = L.map('map').setView([1.118646, 104.048462], 14);
var peta = new L.LayerGroup();
var items = [];
```

The script displays the locations of the distribution of boarding houses equipped with research areas and routing or routes between Politeknik Negeri Batam and boarding houses as follows:

```
var marker = L.marker([1.118646, 104.048462]).addTo(map)
    .bindPopup('<b>Hello world!</b><br />I am a
popup.').openPopup();

var circle = L.circle([1.118646, 104.048462], {
    color: 'red',
    fillColor: '#f03',
    fillOpacity: 0.0001,
    radius: 1500
}).addTo(map).bindPopup('I am a circle.');
```

```
var polygon = L.polygon([
    [51.509, -0.08],
    [51.503, -0.06],
    [51.51, -0.047]
]).addTo(map).bindPopup('I am a polygon.');

L.Routing.control({
    waypoints: [
        L.latLng(1.118646, 104.048462),
        L.latLng(1.121895, 104.047225)
    ],
    routeWhileDragging: true
}).addTo(map);
```

Making a webGIS for the distribution of the location of this boarding house using a local server, namely localhost using XAMPP so that webGIS can be accessed through a local browser. After webGIS has been successfully accessed through the local server. Next, upload the data to web hosting so that webGIS can be accessed via internet media. The data upload process is carried out using FileZilla FTP which is a free or open source application so it is easy to use. The final result of the webGIS distribution of boarding house locations can be accessed via an internet browser by visiting the bit.ly/rumahkostpolibatam page.

3.4. WebGIS Implementation Result

The implementation aims to translate software requirements into an actual form that is understood by the computer in other words this implementation stage is an advanced stage of the design stage that has been done. The following is a design view from webGIS for the distribution of boarding house locations as follows:

3.4.1. Homepage

Fig. 6. Home page.

The home page contains a brief description of the profile, content, and purpose of webGIS. This page is equipped with registration, login, and footer. There is a menu bar that is the basis for webGIS, namely the homepage, list of boarding houses, maps, and contacts.

Fig. 7. Login and registration page.

3.4.2. Dashboard page

Fig. 8. List of boarding houses.

On the admin page fig. 8 there are profiles, boarding house data, messages, and site views. The core of this webGIS is the distribution of the location of the boarding house, the information data of the boarding house, and the coordinate information that displays the distribution and provides information from the boarding house. There is an edit of data which is an improvement and the addition of data to the boarding house. There is additional data information made to the user to register his boarding house.

3.4.3. List of Boarding Houses

The boarding list contains categories that group together male boarding houses, female boarding houses, and male/female boarding houses. Displays a picture and address of the boarding house and is then equipped with information from the boarding house. Users are given access to contact the boarding house owner with the link listed on the boarding house list page.
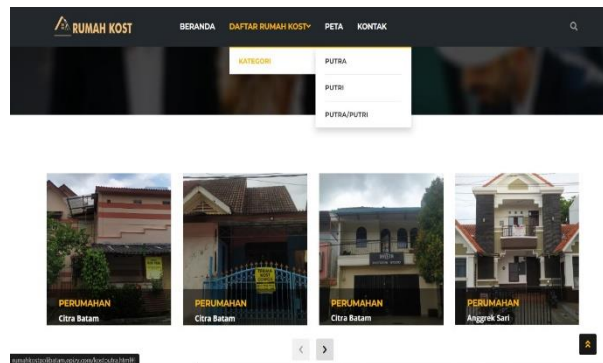
Fig. 9. Boarding house list page.
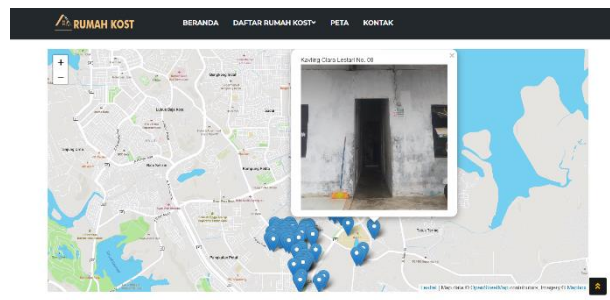
3.4.4. Map Page

Fig. 10. Boarding house list page.

The map page displays 112 data on the distribution of boarding house locations around the Politeknik Negeri Batam campus with a radius of 1.5 km from the campus point. The map displays points by displaying a pop-up address and a picture of the boarding house.

3.4.5. Routing or Routes
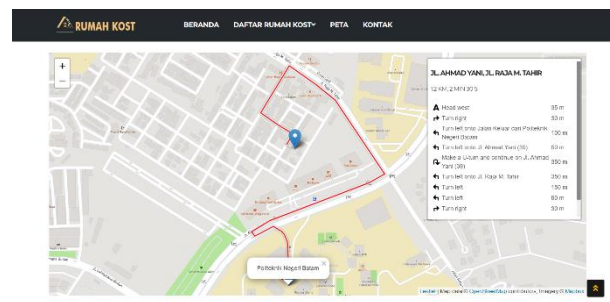

Fig. 11. Route page.

The location page between Politeknik Negeri Batam displays a route that serves as navigation for the user. Equipped with a description of the distance and travel time. Displays pop-ups such as pictures of houses and boarding house addresses. By providing route information from the boarding house attribute data, it is easier for the user to determine the location.

3.4.6. Boarding House Information Page

This page presents information in the form of photos of objects, categories, addresses, areas, cellphone numbers, prices, and facilities as shown in fig. 12 below,
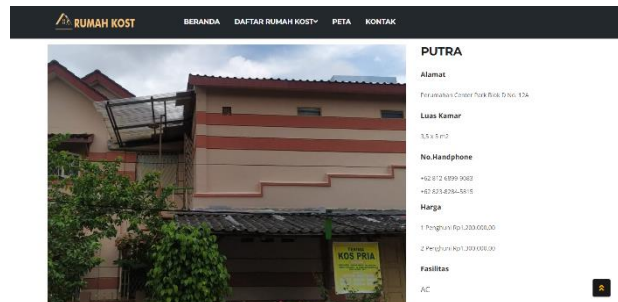

Fig. 12. Boarding house information.

3.4.7. Contact

This page contains a message to send criticism and suggestions to the admin. There is a name, email, subject, and message that is filled in by the user then the message can be sent and will be accepted by the admin as input or assessment from the user.
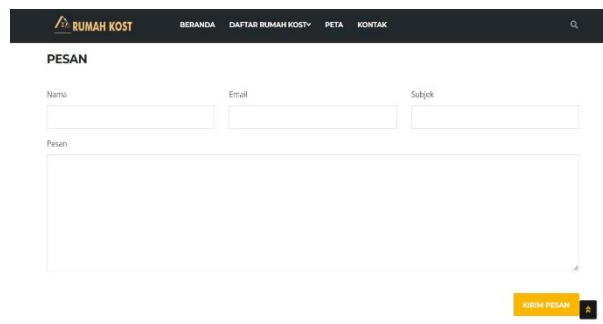
Fig. 13. Contact page.

3.5. Test App

There are 2 stages of application testing, namely functionality testing, and usability testing. System functionality testing is a process of testing specific functions or features of an application by accessing the application using several different internet browsers. Functionality testing is carried out with the User Acceptance Test (UAT) document guide. UAT is generally performed by the client or end-user, usually focusing neither on the identification of simple problems such as spelling errors nor on showstopper defects, such as software crashes. Testers and developers identify and fix these issues during the early stages of functionality testing, testing during integration, and at the system testing stage.

Table 1. Table title. Table captions should always be positioned *above* the tables.

Test case	Expected results	Information
Registration and login	Saved data and verify username and password	Succeed
Add boarding house data	The system adds boarding house data	Succeed
Sending message	The system enters the page that presents the message successfully saved	Succeed
Map of the Distribution of Boarding House Locations	If successful, it will display a Map of the Distribution of the Location of the Boarding House	Succeed
Route distance	If successful, it will display a route map of the distance between the campus and the boarding house.	Succeed
Edit and delete boarding house data	The system edits and deletes boarding house data	Succeed

In the usability test, a questionnaire was distributed to determine an application's level of effectiveness and efficiency in webGIS. The questionnaire contains questions in the use of webGIS which are made using simple language so that it is easy for respondents to understand in filling them out. Measurement of the questionnaire using Likert's method. Questionnaires were distributed online to students using Google Forms to 40 respondents. 10 questions are divided into 3 categories, namely effectiveness, convenience, and application user satisfaction.

The weight of the questionnaire used is a scale of 1-4:

SS   = Strongly Agree weight   = 4

S   = Agree weight   = 3

TS   = Disagree weight   = 2

STS = Strongly Disagree weight   = 1

Table 2. Effectiveness questionnaire recapitulation.

No	Assessment Component
1	Is this webGIS look attractive?
2	Is the location of the boarding house appropriate?
3	Does webGIS help get boarding house information?
4	Is the routing map or route to the location of the boarding house on this webGIS helpful?

Table 3. Convenience questionnaire recapitulation.

No	Assessment Component
1	Is this webGIS easily accessible?
2	Is the boarding house location data easy to find?
3	Is the mailbox page easy to use?
4	Is the boarding house information data easily accessible?

Table 4. Satisfaction questionnaire recapitulation.

No	Assessment Component
1	Are you satisfied with this webGIS?
2	Are you satisfied with the benefits of this webGIS?

While the calculation of the questionnaire recapitulation uses the formula:

$$\text{SDI} = \frac{1}{6} \, x \, (\text{Skor maks} + \text{Skor min}) \tag{1}$$

$$\text{MI} = \frac{1}{2} \, x \, (\text{Skor maks} + \text{Skor min}) \tag{2}$$

The data from this study were measured using a closed questionnaire consisting of 10 questions. The score used is with a weight of 1 to 4, so based on this score, the score ranges from 10 to 40. So we get:

Table 5. Usability test results.

Information	Score
Average	30,7
Standard Deviation	4,833
Maximum Value	40
Minimum Value	11

Based on the data above, a usability test analysis was carried out. Referring to the number of questions a total of 10 questions are measured using a Likert's scale with a score of 1 to 4. The above parameters are then used to categorize the average score of answers into categories that are under those taken from Nana Sudjana, as follows:

Table 6. Research category.

Average Answer Score	Category
MI+1,5 SDI < X ≤ MI + 3 SDI	Very Worthy
MI < X ≤ MI + 1,5 SDI	Worthy
MI – 1,5 SDI < X ≤ MI	Less Worthy
MI – 3 SDI < X ≤ MI – 1,5 SDI	Not Feasible

Analysis of the application effectiveness questionnaire questions contained 10 questions addressed to 40 respondents. The categories are divided into 4 categories with an average score of MI – 3 SDI < X MI – 1.5 SDI is an unfeasible category up to an average score of MI + 1.5 SDI < X MI + 3 SDI with a very decent category. From the analysis of usability testing, the

results of the average answer score MI < X MI + 1.5 SDI are 25.5 < 30.7 32.7495, which means that the average answer score is in the "adequate" category.

3.6. QR Code Creation

In this webGIS, the user is equipped with a smartphone that has a camera and a QR Code scanner application so that it can store more data than barcodes. Thus, making it more practical to use.
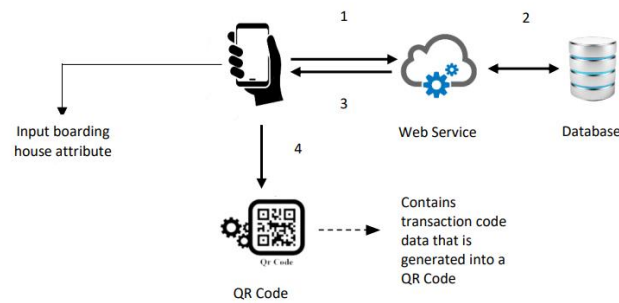

Fig. 14. Generating QR Code on webGIS distribution of boarding house locations.

The following is an explanation in fig. 14. above:

1. In webGIS, the officer first inputs attribute data to save the boarding house data into the database.

2. The web service generates webGIS code and saves it into the database.

3. After successfully saving, the webGIS application will get the webGIS code from the web service.

4. The webGIS code is obtained and then generated into a QR Code.

Fig. 15. QR Code webGIS.

Conclusion

This research produces a webGIS for the distribution of boarding house locations that can be accessed via an internet browser by visiting the bit.ly/rumahkostpolibatam page. With the construction of a webGIS implementation, the distribution of boarding house locations can make it easier for students to find information on boarding houses because webGIS can be accessed easily. The information contained in the webGIS is in the form of boarding house information, location coordinates, and routes. This WebGIS is built using Leaflet JavaScript Library as the main framework. While the management of the boarding house uses the method of data collection, data processing, results, and analysis using Liket's method.

Testing of the webGIS application for the distribution of the location of the boarding house was carried out through functional testing and usability testing. In testing the functionality, it can be concluded that webGIS is successful under the expected results. While the usability test from several 40 respondents obtained usability test results with an average answer score of MI < X MI + 1.5 SDI, namely 25.5 < 30.7 32.7495, which means that the average score of the answers is in the "decent" category. . By using a scale of 1 to 4, it can be concluded that the webGIS application for the distribution of the location of the boarding house is included in the "appropriate" category.

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