Design and implementation of mapping public waste disposal in Jambi City with geographical information system based on android application

Ade Oktarino, Listautin and Saut Siagian
1University Of Adiwangsa Jambi, Jambi, ID

jambeiy57@gmail.com

Abstract. This system is an application that is expected to give the solution of the problems currently faced by the Agency in Jambi City. This system is designed to be as can be used by users to send problems regarding the waste disposal to the Jambi City Agency and can be used to find the location of the public waste disposal that is closest to the user's location by using Android; can be used by the Jambi City Agency's staff to make the Jambi City to be cleaner if there is a problem regarding the public waste disposal that sent by the user; and can be used anywhere, because this application is designed and can run on Android-based smartphones.

1. Introduction
Waste is defined as a residual result of activity or activities that are solid, both produced by humans and nature, and deemed no longer useful. Waste is an inseparable part of human life, because in their lifetime, everyone must produce Waste. The issue of waste now has become a problem that can’t be underestimated because the impact can be caused is that poor waste management can affect people's lives widely [1].

The development of an area is always followed by an increasing population and it will cause an impact caused by the increasing tendency of waste. Jambi currently has an area of 205.38 km2 with 11 sub-districts, 62 urban village and a population of 591,134 people in 2017 thus environmental problems that commonly occur in urban environments are poor waste management. For now waste management in Jambi City Government was represented by the Office of Environment, said that currently there are 380 Units of Public Waste Disposal, 752 Units of 5 types, 56 units of trash containers, and 1,355 waste carts scattered in each RT (neighbourhood association) at each urban village to maintain the cleanliness of Jambi City [1].

The Department of Environment has jobs: data collection on the potential of solid waste services, hygiene counseling, monitoring and control of cleanliness, waste collection, waste transportation, waste management techniques, procurement of equipment and equipment for cleaning, management and maintenance of waste facilities. In addition to the Jambi City Environment Office, the community also has an important role in waste hygiene. In addition, there are still many people who do not know where the nearest public waste disposal is located in Jambi City.

Based on the observations made by the author, the people of Jambi still often dispose of waste not in the place, this situation can be seen that there are still many people who dispose of waste out of place, such as the large amount of waste disposals on the roadside.
This state can be seen based on the results of questionnaires from 50 respondents conducted by the author. The results of the questionnaire were: 16 respondents (32%) disposed of waste in its place and 34 respondents (68%) did not dispose of waste in its place, 18 respondents (36%) knew the location of the waste disposal and 32 respondents (64%) did not know the location the nearest waste disposal in Jambi City, as well as 44 respondents (85%) stated that they were willing to use the application on the cellphone to find out the location of the nearest waste disposal and 8 respondents (15%) stated that they were not willing to use it.

Therefore to help the Jambi City Environmental Service in improving the services provided to Jambi people and to help carry out the mission of "Improving the quality services of solid waste management and city cleanliness based on environmentally friendly" as well as helping Jambi people in providing the right location for Waste Disposal.

A geographic information system (GIS) can be defined as a computer application capable of performing virtually any conceivable operation on geographic information, from acquisition and compilation through visualization, query, and analysis to modeling, sharing, and archiving[2].

G.I.S systems work with two different types of geographical models namely Vector and Raster. In the vector model, information about points, lines and polygons is encoded and stored as a collection of x, y coordinates. Thus the location of a point feature is described by a single x, y coordinate[3][4]. The vector model is best suitable for describing discrete features[5][6]. The Raster model is evolved to model continuously varying features such as soil type. Modern G.I.S systems are able to handle both vector and raster models[7].

A geographic information system[8] is needed by utilizing a Mobile-based system [9] Android[10][11][12] that is able to accurately inform the location of Public Waste Disposal. Based on the background above, the authors are interested in conducting research and pouring in the form of a Proposal "Designing and Implementing Mapping Applications for Public Waste Disposal in Jambi City with Geographical Information System Based On Android Application".

![Figure 1: The State of Public Waste Disposal](image1.jpg)
2. Methodology
To provide guidance in the preparation of this research report, it is necessary to have a clear framework of stages. This framework contains steps that the researcher will take in solving the problem to be discussed [13][14]. The research framework used is as follows:

- **Identify Problems**: At this stage the authors identify the problems that exist. It aims to obtain ideas, ideas and motivation on research regarding information on the nearest public waste disposal in Jambi City based on Android. The authors’ results of this activity conclude that the people of Jambi City still dispose of waste improperly, for example there are still many people who throw waste on the roadside. This is because the people of Jambi City do not know the location of the nearest public waste disposal from the location of the residence.

- **Literature Study**: At this stage the authors learn and understand theories and concepts that are relevant to the problem under study and becomes the theoretical basis of this research. This literature study comes from books, journals and other references.

- **Data Collection**: At this stage the authors collect relevant data to make the application by using several methods, namely: Questionnaire, Library Research, Interview, and Observation.

- **System Analysis**: The data analysis phase is the stage that is carried out after the data collection has been completed. At this stage the researcher analyzes the current system. After the analysis phase is complete, the design phase begins to determine the description of the system process that will be created or developed.

- **System Development**: At the stage of system development, the authors use a system development method, called the waterfall method. According to Pressman [6] waterfall is a classic model that is systematic, sequential in building software.

*Figure 2. Research Framework[12]*

*Figure 3. Waterfall Method [10]*
Writing The Research Report: At this stage a report is prepared based on the results of the study using research methods that are relevant and directed at the main problems that occur.

3. Analysis and System Design
System analysis is one technique to describe complaints reports and look for an overview of the current system at the Jambi City Environmental Agency. Based on the results of observations made by the authors, at this time the people of Jambi City still often dispose of waste not in its place, such as the amount of public waste disposal in the roadside. This happened because the people of Jambi City did not know the location of the public waste disposal in Jambi City. The Jambi City Environment Agency does not yet have a specific application to help the community to be able to find out more easily the location of the coordinates of the public waste disposal in Jambi City which are closest to the user's position. Based on the problems that exist in the Jambi City Sanitation Service, the authors try to design the application for the nearest public waste disposal information in Jambi City which runs on the Android operating system. This system is an application that is expected to provide a solution to the problems being faced by the Jambi City Environmental Agency. The system that will be designed are to provide a coordinate point for the entire location of the public waste disposal in Jambi City with an android application that is more attractive to the community, and it can facilitate the community in finding a public waste disposal location in the city of Jambi quickly based on the user's position.

To achieve the results that are in accordance with the above requirements, it requires several planning stages consisting of 5 stages: Designing the program structure [6], Designing Use Case Diagrams, Designing Class Diagrams, Interface Design, and Designing a Flowchart [9][4][6].

4. Implementation and System Testing
In this section, the stages of system implementation will be explained, the implementation of the results of the process of translating the design into an application program that can be used by users. There are several interface will be show here, such as: Main Course Menu, Menu of public waste disposal, Menu of Coordinate public waste disposal, Menu of Chose the public waste disposal, Menu of Route Tracking, Menu of Start Tracking, Login Menu, Registration Menu, Admin’s Menu, and Menu of public waste disposal for user.

a. Main Course Menu
   This Menu is the main display of the information application of the nearest Public Waste Disposal in Jambi City which appears after the opening page.

b. Menu of public waste disposal
   This menu page is a page that displays the sub-districts in Jambi City which are displayed in the form of a list.

c. Menu of Coordinate public waste disposal
   In this menu page, the selected location point will appear after the user selects the location point on the map. This page is a page that displays address, latitude and longitude information.

d. Menu of Chose the public waste disposal
   This menu will appear after the user selects one of the Districts in Jambi City. This page is a page that displays a map of the location points of all the public waste disposal in the District chosen by the user.

e. Menu of Route Tracking
   This Route Tracking page will appear after the user selects the click for tracking menu. This page is a page that shows the location of the trash route from the user's location point.

f. Menu of Start Tracking
   This menu is a page that displays the path of the route route to the trash location based on the user's position. To find the location of the public waste, the user must follow the route displayed by the application.

g. Login Menu
The user's login page will appear after the user selects the Public Waste Disposal menu. This page is a page that displays a username and password that is only owned by the user to add the location of the public waste disposal and send problems regarding the public waste disposal to the Agency of Jambi City. Previously the user must have a username and password to log in. If the user does not have a username and password then the user must register first by selecting the create account menu on the login page.

h. Registration Menu
The registration page will appear after the user selects the account creation menu on the login page. This page is a page that serves to get a username and password in order to add to the location of the public waste disposal and send a problem. To log in your username and password must wait for activation from the party from the Administrator. Before the username and password are activated by the admin, the user will not be able to enter.

i. Admin’s Menu
This page is only for Administrator. Before entering this page the officer must enter a username and password. On this page there are two menu choices, namely the add a new location menu which serves to add the location of the public waste disposal coordinate and the reports the problem menu that serves to report the problem regarding the trash to the Agency of Jambi City.

j. Menu of public waste disposal for user
This page is for all users who use the application. Before entering this page the user must enter a username and password. On this page the user can only report problems regarding the trash to the Environmental Office of Jambi City.

[Figure 4. Implementation of Android Application]

Other features of this application that user can define the new public waste disposal and add them into this application’s database, such as: Adding Menu, Capture and Send New Location, Reporting Trouble Menu, and Send Report Menu.

a. Adding Menu
Users must log in first before adding the location of the public waste disposal. This page displays information on latitude, longitude and accuracy of the location of the public waste disposal.
b. Capture and Send New Location

The send location menu page is a page used by the user to send the coordinates of the location of the public waste disposal that has been taken. Later it will automatically be stored in the database. On this page the user must fill in the address and information displayed by the application.

c. Reporting Trouble Menu and Send Report

This menu page is a page that is used by the user to send problems that occur regarding the public waste disposal to the Agency. Before sending a problem the user first logs in. After the login user takes the coordinate point of the public waste disposal location, the send problem page appears. On this page, the user must fill in a description of the problem that has occurred in the public waste disposal that you want to report to the Agency.

![Image](image.png)

**Figure 5.** Menu Adding New Location and Reporting New Location from User

After the completion of the design of the application for the nearest public waste disposal in Jambi City, then the next step to do is to test the results of the application design. In this case the test is carried out with the aim of knowing the extent to which the results provided by the application have been designed.

| Module tested            | Testing procedure                  | Input                  | Expected output          | Obtained Results            | Conclusion   |
|-------------------------|-----------------------------------|------------------------|--------------------------|-----------------------------|--------------|
| Main Course Menu        | Users click on the application    | Click the Application icon | Display the main menu of the application | Display the main menu of the application | Good         |
| Menu                    |                                    |                        |                          |                             |              |
|                         |                                    |                        |                          |                             |              |

**Table 1.** Testing All Menu
| Menu Of Public Waste Disposal | -User clicks on the Public Waste Disposal menu  
-Choose the desired sub-district  
-Select the coordinate point of the trash location  
-Select the tracking button  
-Click start | Click sub-district, click location point, click tracking | Show location of Public Waste Disposal can based on user's position (internet connection must be strong) | Good |
|---|---|---|---|---|

| Menu Login User | -The user clicks the add location menu  
-Input the username and password  
-Select login | Click menu add location, username and password, click login | The page appears, add the location of the public waste disposal and report the problem. | Good |
|---|---|---|---|---|

| Registration Menu | -The user clicks the add location menu  
-Select create an account  
-Input personal data  
-Choose a list | Click menu add location, click create account, self data, click register. | The message "send registration account" appears | Good |
|---|---|---|---|---|

| Menu Create New Location | -The user clicks the add new location menu  
-Click add  
-Take a photo  
-Fill new location data  
-Click save location | Point the coordinates of the trash location, click save. | The message "Successfully send a new location" appears. | Good |
5. Conclusion
This research produced an application for mapping information on public waste disposal in the city of Jambi that run on the Android operating system. And for the community officers of the Agency Jambi City, this application can be used to find the coordinate point of the location of the waste that is closest to the user's position. And give the information about the nearest public waste disposal site in Jambi City that can be used to send the new location of the public waste disposal and report all the problems related to the public waste disposal to the Agency Of Jambi City.

References
[1] Dinkes Provinsi Jambi. 2015. Profil Kesehatan Provinsi Jambi 2015.
[2] Goodchild, M., Egenhofer, M. J., Feges, R., & Kottman, C. (Eds.). (2012). Interoperating geographic information systems (Vol. 495). Springer Science & Business Media.
[3] Sultana, A., & Kumar, A. (2012). Optimal siting and size of bioenergy facilities using geographic information system. Applied Energy, 94, 192-201.
[4] Jones, M. T., McClendon, B., Charaniya, A. P., & Ashbridge, M. (2011). U.S. Patent No. 7,933,897. Washington, DC: U.S. Patent and Trademark Office.
[5] Tomlinson, R. F. (2007). Thinking about GIS: geographic information system planning for managers (Vol. 1). ESRI, Inc.
[6] Chuvieco, E., Aguado, I., Yebra, M., Nieto, H., Salas, J., Martin, M. P., ... & De La Riva, J. (2010). Development of a framework for fire risk assessment using remote sensing and geographic information system technologies. Ecological Modelling, 221(1), 46-58.
[7] Otto, Huisman & Rolf A. 2009. Principles of Geographic Information System. ITC Netherlands: Educational Exbook Series;1.
[8] Balakrishnan, P., Saleem, A., & Mallikarjun, N. D. (2011). Groundwater quality mapping using geographic information system (GIS): A case study of Gulbarga City, Karnataka, India. African Journal of Environmental Science and Technology, 5(12), 1069-1084.
[9] Dennis, Alan; Wixom, Haley Barbara: & Tegarden, David. 2010. Systems Analysis and Design with UML Version 2.0 : An Object-Oriented Approach. Second Edition. United States of America : John Wiley & Sons, Inc.
[10] Intania. 2012 . Sekali Baca Langsung Inget Mengupas Lengkap All About Android . Cetak Pertama. Jakarta : Kuncikom.
[11] Leh, M., Bajwa, S., & Chaubey, I. (2013). Impact of land use change on erosion risk: an integrated remote sensing, geographic information system and modeling methodology. Land Degradation & Development, 24(5), 409-421.
[12] Chang, K. T. (2016). Geographic information system. International Encyclopedia of Geography: People, the Earth, Environment and Technology: People, the Earth, Environment and Technology, 1-9.
[13] Pressman, Roger S. 2001. Software Engineering : A Practitioner’s Approach. Fifth Edition. New York : McGraw-Hill.
[14] Kendall, E. Kenneth; & Kendall, E. Julie. 2011. Systems Analysis and Design. Eighth Edition. United States of America : Pearson Education Inc.
[15] Maliene, V., Grigonis, V., Palevičius, V., & Griffiths, S. (2011). Geographic information system: Old principles with new capabilities. Urban Design International, 16(1), 1-6.