

Redesigning More Resilient Sahana System For Disaster Information In Indonesia

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Abstract

This application is a disaster information system in Indonesia using Sahana platform that has many unique features of the integration Sahana disaster with some applications that have been built independently in the previous year of mudflow in Sidoarjo, Solo in Bojonegoro Flood, and Forest Fires in Kalimantan. Addition, this application provides a virtual feature class that is learning GIS and Sahana, complete with an online test and the results. Since the system is web-based, then use the appropriate technology that is MapServer as web server, php, html, and javascript as a system builder and PostgreSQL for data storage. To improve the security of these applications also added SSL and Mod Security. SSL to secure data line and mod security to prevent attacks SQL Injection and Cross Site Scripting. Two of these securities will keep the system from attack, so the important data such as victims of disasters, infrastructure and map safe. With this integration, these applications into a complete information system, safely and in accordance with local conditions of each disaster.

Keywords : Disaster Management, Sahana, Virtual Class, Integration System.

1. Introduction

Indonesia is prone to disaster because it is located between several plates of the earth. But the government is still slow in handling disasters so the greater the impact of disasters. In addition unpreparedness society and government become a major factor in disaster management. Consequently not only the people who become victims, but various infrastructures such as transportation, communications, emergency management, all of them paralyzed. With the information technology all of these problems can be overcome by either of linking all relevant elements such as governments, communities, donors, and volunteers so that they can work together as a single unit.

Actually in Indonesia has been trying to apply information technology that is used as the Sahana disaster management in the earthquake in Yogyakarta in 2006, but its application is not optimal because it has different data formats with the conditions in the affected areas, the data infrastructure and real conditions are not clearly visible.

This application integrates with multiple applications Sahana disaster that was built independently in the previous year include Lapindo mud disaster in Sidoarjo, floods Solo in Bojonegoro, and forest fires in Kalimantan. Results of integration provides unique features in accordance with the conditions of the disaster areas such as data infrastructure, data of victims, the assistance data, latest news, reports, and disaster evacuation procedures. In addition there is a virtual feature class to which the user can learn GIS and Sahana online and conduct online test to determine the user's understanding of the learning materials provided.

With the unique features of this application not only provides comprehensive information about the disaster but becomes learning information system online. This application is very useful for all people, including government, community, students and organizations concerned with disasters. Governments, relevant organizations and donors can coordinate with each other easily so the disaster can be addressed appropriately. For communities and volunteers to access this application then they will get a lot of information about post-disaster conditions such as casualty data, data loss, and the assistance provided. To support the securities side, this application is protected with SSL. SSL uses public key cryptography, which protects the entire transportation data and information between the client to the server. So if the information is taken non the way, will not be used by the hackers. Besides there are also additional security SSL is a web applications. Mod Security as a firewall as an additional security to secure the data from SQL Injection and Cross Site Scripting. From the description above it is expected that with the integration of GIS can integrate existing applications into the GDMS making it easier for Sahana disaster management in one application.

2. Design System

Here is an integration process with several applications GDMS Sahana was mentioned earlier that it becomes a new information system is a complete disaster:

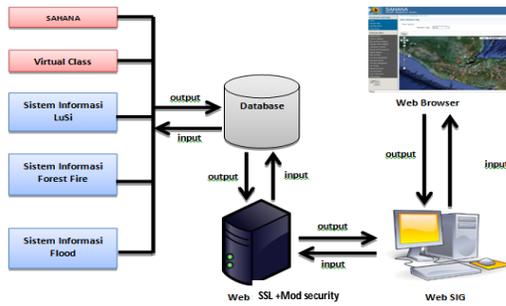


Figure 1. System Integration Block Diagram

Here is a flow chart that describes the system design system integration process:

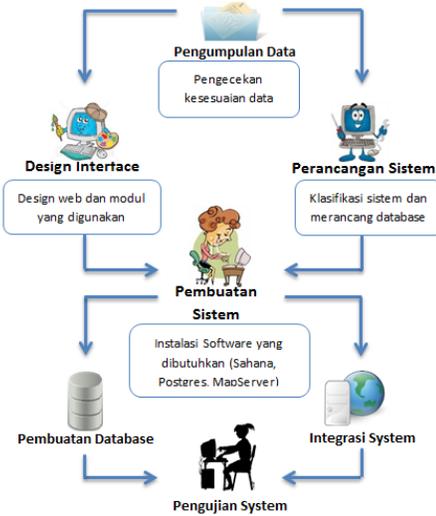


Figure 3. Stages of Creation System

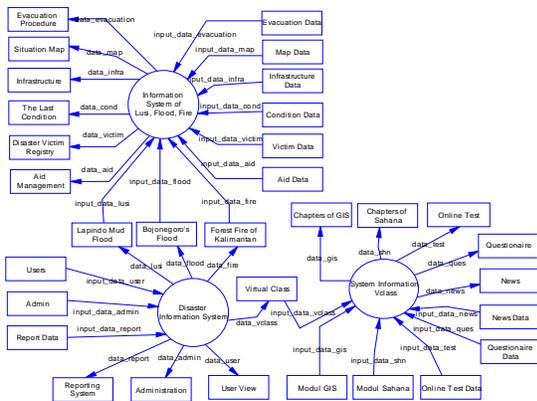


Figure 2. Data Flow Diagram Level 0

2.1 Input System

The data entered is the learning materials and questions about Sahana and GIS. Besides the input data is data that disaster management had been established earlier.

Table 1. Database used

database	no of table	function
vclass	11	Storing the data for the learning pages and Sahana GIS
lusi	22	Storing data for lapindo mud flood
fire	23	Storing data for forest fire in Kalimantan
banjir	23	Storing data for Bengawan Solo Flood in Bojonegoro

2.2 Process

Here is the stage of making the final project of this system:

- Stages of data collection is performed to determine whether existing data on the application to be integrated in accordance with the features of Sahana.
- Interface design stages undertaken to compare the features of Sahana with application features that will be integrated so it gets a new unique features.
- Stages of system design done for designing the system and the data flow from the new system is the result of integration with the old system.
- Stages of making Sahana system include the installation (the installation process can be seen in appendix) and other software needed. In addition there are two branches of this stage is the stage of making the database and system integration. Stages of manufacture made to update the database on the application of integrated database while the system integration phase is the stage of data capture and start scripting until the system was completed.
- Stages of system testing is performed to determine whether the system output in accordance with the expected results.

For more details, the following is an overview of system integration between the old with the Sahana system so as to produce a new system.

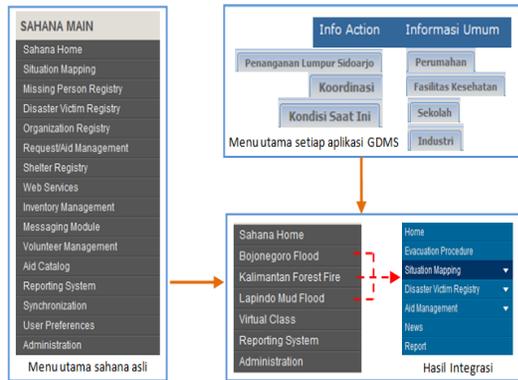


Figure 4. Integration System

To clarify the process of integration, the following will explain the process of data collection a tone of the menu mapping situation. Menu mapping situation at the end of this project to renew the original Sahana system. Situation mapping is updated depict the actual conditions in each affected area, including a map of the disaster, local infrastructure, and the final condition of the affected areas. Amendments clarify the image below:



Figure 5. Integration of Situation Mapping

From the picture above can be seen that the results of the integration of Sahana with previous applications generate a lot of advantages in that the data presented a more complete and dynamic. The following comparison table:

Table 2. Comparison Situation Mapping of New System with the Older System

Older System	Sahana Original	Integration System
Not dynamic	Features are not complete such as: <ul style="list-style-type: none"> Infrastructure The Last Condition 	Complete features such as: <ul style="list-style-type: none"> Infrastructure The Last Condition

While the data collection process for each of these features can be seen in the image below:

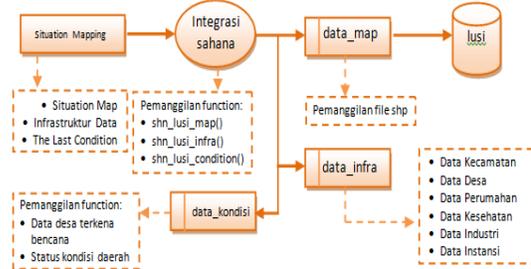


Figure 6. Process of Integration System in Situation Mapping

Then to display the data used shp template as follows disaster

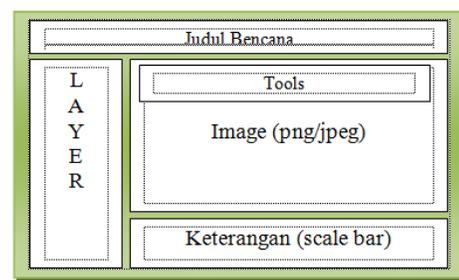


Figure 7. Template SHP

3. Experiment and Analysis

3.1 Experiment

Test phase was to determine the success rate of applications that have been built as well as to determine whether it has been going well according to predetermined specifications. In this chapter, the tests done specifically on menu that is integrated virtual application class and application "Lapindo MudFlood" because it has the most complete data. The following is the main page of the application made:

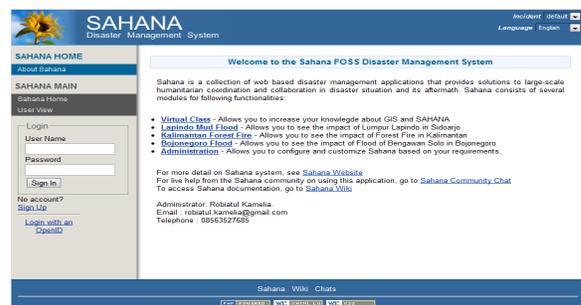


Figure 8. Main Page

3.1.1 Login User

To get in on the unique features are already integrated, the user must log in first as shown below:



Figure 9. Login User Form

The system is divided into two user among registered user and admin. User login function to determine the condition of the disaster area and access a virtual class, while the admin in charge of managing all the data presented in these information systems.

3.1.2 Anonymous User

This page can be accessed by any user without a login. The information is presented only data in general disaster such as infrastructure, casualty data, and data support as seen in the picture below:

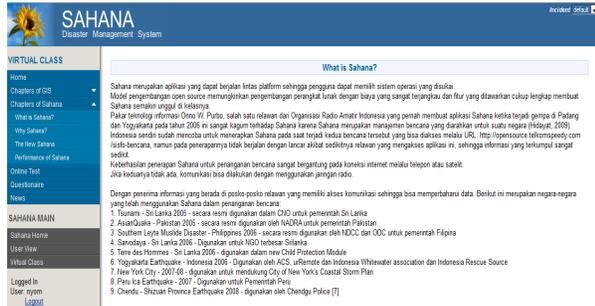


Figure 10. Anonymous User Page

This page can be accessed by any visitors, so to access this page does not have to do the first login.

3.1.3 Registered User Page

To access this page a visitor must login process as user first. If you do not already have a user account then the user must register themselves in advance with registration form like the picture 11. And if the user login process is successful then the user page will appear as in Figure 12.



Figure 11. Registration User Form



Figure 12. Registered User Page

On user pages, as well as the anonymous user pages, but on this page there are additional features of the Virtual Class.

3.1.4 Virtual Class

Virtual Class is a feature that can be accessed by registered users, where the user can enjoy this feature of GIS learning module, learning module Sahana, Online Test, Questionnaire, and News. With this feature users will find new knowledge about GIS and Sahana.

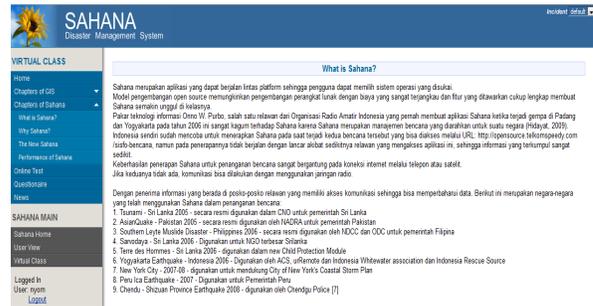


Figure 13. Virtual Class Page

3.1.5 Online Test

This page contains questions about learning and Sahana GIS as a measure of user understanding of the material presented. Figure below is a non line test that is presented:

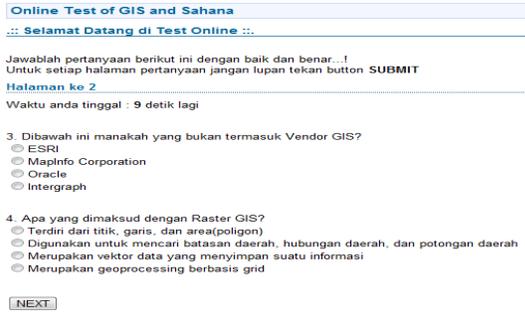


Figure 14. Online Test Page

After the user completes an online test, then the user can see the results of its tests online, as shown below:



Gambar 15. Online Test Result Show

3.1.6 Administrator Page

Just a show to access the user page, to access the admin pages also need to login. Admin in this final project has two categories admin roles as organization and role as an administrator. Here's his explanation:

1. Organization Admin Role

Organization admin role tailor-made to the parties that will update the data every disaster, which issued by the BPBD, Government, Satkorlak, or other similar organizations. Here is one page that can be accessed user with admin role organization:

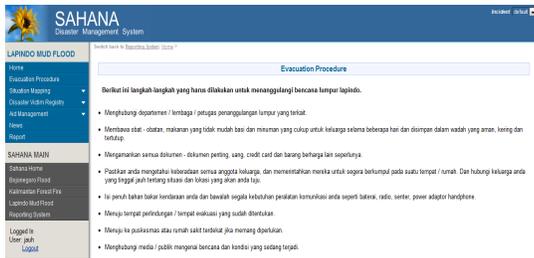


Figure 16. Organization Admin Page → Evacuation Procedure

2. Role Administrator

Administrator role is a role with the highest privilege where an administrator can find out all user activities with roles below. System administrators who will manage the information presented. Picture below is one example of the admin page to add data assistance. The data presented support the far more complete than the old system.

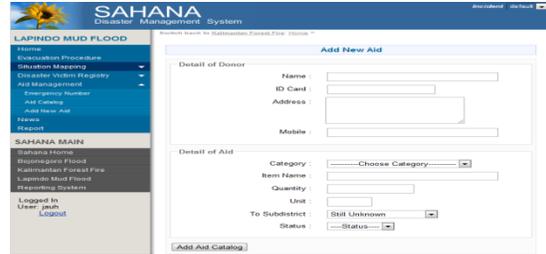


Figure 17. Administrator Page → Add New Aid

If the comparison between the old system to new system, the administrator page at the end of the project is far more complex than the old system.

3.1.7 Situation Map Page

This page is the result of integration of Sahana with the old system which was built in dependently in the previous year. With the integration of this information is presented more quickly accessed than using the old system.

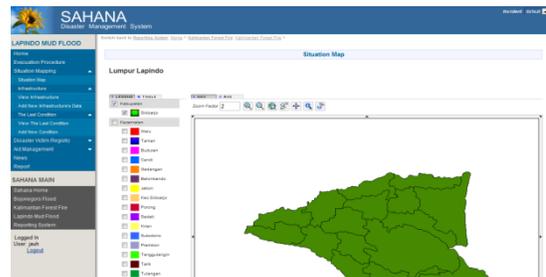


Figure 18. Situation Map Page

3.1.8 Module SHP

Shp modules created are still using a simple design and further highlight the functionality in displays shp data into the browser. With hopes of improving performance when ditampilkan simultaneously two systems at once disaster. Following trials on the previous application.

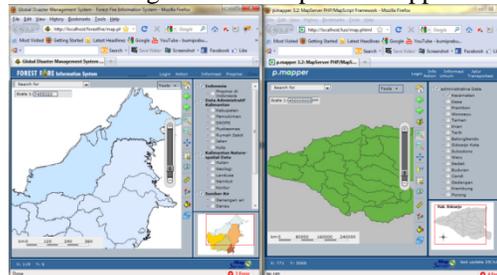


Figure 19. Show old applications

At first the application runs perfectly on the run together. Looks up the layer on which the application is performing as well. But not necessarily when running the

query together. Here are the screen when done collectively or load a query layer on top of it.

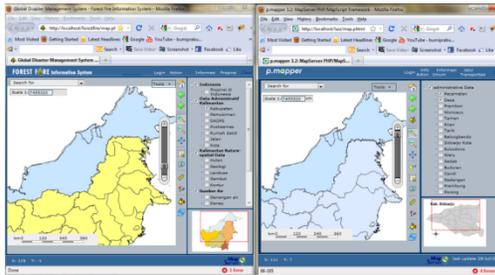


Figure 20. Featuring two applications and perform queries

We can see that there is a problem if we do a query on a layer bersaman. Can be seen on the left of the layer kalimantan can still display layer on top. However, different layers in Sidoarjo, in this condition Sidoarjo visible layer displays a clear layer of Borneo certainly no connection at all with the application of Sidoarjo mud. Then we compare it with a new application created with a simple module shp. Here are the results:

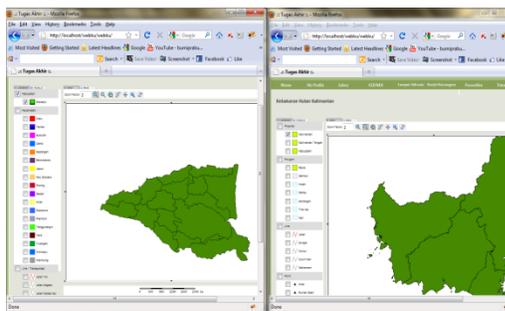


Figure 21. Featuring two applications with the new module

At the same time we open the beginning of a new layer to the application using the module shp. Looks left side of the Sidoarjo Mud adalh SIG and SIG Forefire right are Kalimantan, visible applications run normally when accessed together as in the previous application, if performed without performing the query. Then the next trial we do process a query on two applications simultaneously. Here are the results of the query process when done together.

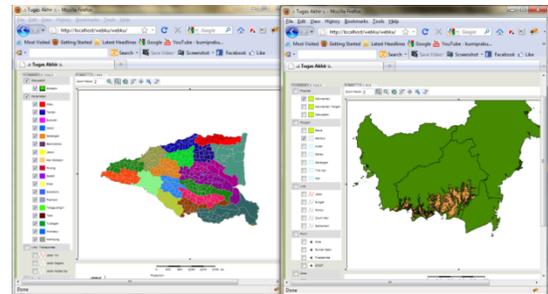


Figure 22. Featuring two new modules and applications to run queries upper layer.

Of the experiments done then we can see in new applications using shp module, the application can run properly display the layers in accordance with the diquerykan or ordered. So it can be performed together without disturbing other applications as above.

3.2 Analysis

Analysis of test results performed on the output of the disaster information system is built. The results of this analysis is to determine the accuracy of the application in providing information to the user, whether the information presented is informative and appropriate. The following is an analysis of the results of experiments performed.

3.2.1 The Older System

a. GDMS Project

As already mentioned earlier GDMS integrated project that includes the Lapindo mud disaster, floods solo in Bojonegoro and forest fires in Kalimantan. All applications are built independently and disaster information displays include:

- Disaster - which consists of the sub menus on evacuation procedures and data of victims and material losses
- Coordination - which consists of sub menu reports, infrastructure, material aid, and emergency numbers
- Current Conditions - featuring the latest condition of any disaster area
- General Information - consisting of infrastructure in each of the affected areas include housing, schools, health, industry, and agencies

Unfortunately, information systems are not built on a full dynamic so that the data presented are not up to date such as evacuation procedures, victim data, material losses, and data infrastructures.

b. Modul Learning GIS

The system presents learning GIS information, questionnaires, and the third link GDMS previous project. GIS learning module presented is complete and has been dynamic. The questionnaire presented a questionnaire to the system being presented. And there is a link page to see the GDMS already built previously. Unfortunately, this information system is still not quite complete because the project was built GDMS presented separately / independently.

c. Sahana Original

As already mentioned above the Sahana disaster management system which is open source. This information system provides features that are quite complete, including a feature to view a map of disaster situations. Unfortunately, to see a map of the situation, the user must connect to the internet. And if implemented in Indonesia, the disaster area would be difficult to connect to the internet due to infrastructure damage. Actually Sahana support for offline maps, using GIS and use the PostgreSQL database for data storage. But until the end of this construction project books, Sahana still not provide the feature. So far Sahana still using the MySQL database.

3.2.2 Sahana Integration

Disaster information system that is built is the result of integration between the project GDMS previous warp application, the application floods, and fires as well as application of GIS learning modules with Sahana disaster management system. The results make the integration of disaster information systems are built to have a complete and efficient features. If drawn would look like in the picture below:

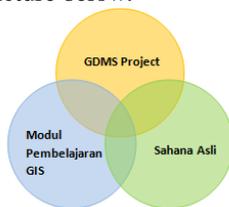


Figure 23. Integration Process System

The results of the third meeting of the object in the image above a new system called Sahana disaster information system or integration. The table below will explain the differences in the old system with a new system:

Table 2. Comparison of old and new systems

	Aplikasi GDMS	Aplikasi pembelajaran GIS	Sahana yang asli	Sahana integrasi
presentasi on of map	offline using pmapper platform	there is no map, only the links that refer to the application independently GDMS	must be online using google map	offline using integration of chameleon and sahana
dynamic web	not fully dynamic	dynamic	dynamic	dynamic
feature	fairly complete but less informative presentation	just modul learning and questionnaire	complete but not in accordance with local conditions of each disaster	complete because of the integration between the three application
access speed	not fast enough for using pmapper	fast	fast	fast
modul learning	none	just GIS	none	GIS and Sahana
online test	none	none	none	online test about GIS and Sahana
news	none	available	none	available for each disaster

With the integration process is the disaster information system into a complete information system, in addition to presenting data disaster information system also provides online learning modules and tests to determine the extent to which users understand the material presented.

3.2.3 Administrator

An administrator has the task of managing the web pages and manage users. To meet the needs of admins are provided admin page which has the facility to update, delete, or add all the data starting from the infrastructure data, victim data, disaster data, data of learning materials, online test data, donor data, data updates, and much more . Thus the information system provides information up to date as it can be updated at any time.

3.2.4 Organization Admin

An organization administrator has a duty to manage disaster menus that exist in this disaster information system. Organization of a user with admin role can add data such as data disaster victims, donor data, data assistance, emergency numbers, and data infrastructures. With the organization administrator, an administrator tasks become lighter due to be assisted by the organization admin. Users with this role is used to BPLS, Satkorlak and local governments.

3.2.5 Module SHP

In the process of making shp module can not be separated from the previously existing system, which uses pmapper. After testing on old applications that use pmapper it is known that this framework has its disadvantages. As in Table 3.2 below

Table 3. Comparison shp on old and new systems

Old System	New System
Not able to walk normally when used for more than one disaster at a computer. Because the temporary imagenya used together	Able to serve multiple applications within a single computer because the design of the temporary image each application individually so as not to clash with other applications
Pmapper use of a lot of javascript to display the shp to png and has many tools that make pmapper itself becomes slow when loading the data shpnya own.	Shp module can be faster because the process of displaying images using a short process by using a simple php.
Function tools that used a lot so it takes a lot of memory resouce	Function tools that used a little so resource consuming less memory
Not able to be integrated with Sahana, because it is itself a complex framework.	Capable be integrated with Sahana because the form has a simple module

4. Conclusions

From the test results of this disaster information system can be concluded:

1. To perform the integration of every disaster with Sahana, database synchronization is required for the system to the information presented have complete data.
2. Creating an information system must consider the structure of the database that the bedrock of the system flexibility to be easily developed.
3. Disaster information system presents the results of the integration of disaster information and learning with a complete disaster.
4. Sahana module integrates with shp, so as to display data shp each disaster.

5. With the security of SSL and Mod Security is able to present web safe from SQL injections and Cross Site Scripting
6. Sahana integration with local disasters such as mud Sidoarjo, Kalimantan forest fires and floods Bojonegoro easier to conduct risk management in the disaster area.

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