

Design of Disaster Anticipation Information System (SIAB) with Case Study in Mount Merapi, Yogyakarta

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ABSTRACT

The impact of the loss felt by humans due to natural disaster tends to be greater than other disaster in general which can cover materially and even human lives. The problem that experienced by society is time to access information that needed, like mitigation education and information about a place and saves evacuation plot when an eruption happens. Based on these conditions, this research is conducted to give society a simplicity on access that information via information technology. The information technology will be implemented with mobile application and website that be supported with data where it connect in real time with data from BPPTKG and it also uses GPS technology to show the save evacuation spot. The method of this research is consists of planning and system design and development. The design of the system consists of the design of the flow diagram of the creation of anticipation disaster information system, the data flow diagram, the use case diagram design, the Entity relationship diagram design, and the user interface. All the design results will be a guide in making the system.

Keywords: disaster, mitigation education, evacuation, disaster anticipation system.

INTRODUCTION:

A disaster is an event or series of events that threaten and disrupt the lives and livelihoods of people caused by natural factors and/or non-natural factors and human factors resulting in human casualties, environmental damage, property losses and psychological impacts (UU RI PB No. 24/2007).

One of the natural disasters that cannot be stopped is the erupting mountain. Volcanic disasters can occur when the mountains are active. Mount Merapi is one of the most active mountains in Indonesia, especially in Java. Unfortunately, this mountain is surrounded by densely populated areas (Ariyanto, 2014). The last eruption of Mount Merapi occurred in 2018. In 2010, there was an eruption of Mount Merapi which resulted in 151 people died, 320,090 people displaced, and more than 290 houses damaged (Alfarizi & Mahbub, 2018).

Natural disasters cannot be stopped by humans, but humans can reduce the number of casualties and losses caused by natural disasters. The Center for Research and Development of Geological Disaster Technology (BPPTKG) presents data that can be viewed quickly shortly after the disaster occurred (real time) on the website or the official application of BPPTKG. The BPPTKG's website and application give more

information about Mount Merapi, especially when disasters happen. But the guidance on evacuation during a disaster is not available.

Karang Taruna Bakti Mudal is a youth organization located in Cangkringan on the slopes of Mount Merapi which was affected by the eruption of Mount Merapi. But the problem that Karang Taruna Bakti Mudal members face is to access all information that they needed about Mount Merapi such as the eruption, mitigation and many more. Members of the Karang Taruna Bakti Mudal need more means to access information specifically related to the status of Mount Merapi, mitigation education, and the information which is related to non-dangerous evacuation sites and the fastest routes when the eruption happens. That information needs to deliver on a simple way into members of Karang Taruna Bakti Mudal and the other people who live close to Mount Merapi, such as using the smartphone to deliver that information. However, the specific application that is in accordance with the needs of Karang Taruna has not been developed by the agency tasked with monitoring, research and development of technology for Mount Merapi like BPPTKG.

The monitoring system automatically gives a signal in the form of a siren that will be heard during an eruption (eruption of Mount Merapi). However, members of the Karang Taruna Bakti Mudal and the other people did not know the exact information about the direction of the eruption and the safe area and the access to that area. This can be overcome by utilizing information technology and it supported with data that are connected in real time because the data are coming from BPPTKG. Safe areas can be accessed with information technology that supports GPS.

LITERATURE REVIEW:

DISASTER ANTICIPATION INFORMATION SYSTEM:

Information is data that has been processed into a form that is meaningful to the user, which is useful in making current decisions or supporting information sources. Data does not have a value while information already has a value. Information is said to be valuable if the benefits are greater than the cost to get it (Kusrini & Koniyo, 2007).

Five definitions of information are identified: information as subjective knowledge, information as user data or as a thing, information as a resource, information as a commodity, and information as a constitutive force in society. Attempts to integrate this perspective on the information must consider the context of information processing. Individuals, organizations and societies are concerned with the role that information can play in processes such as decision making, learning or innovation, whereas information professionals and information systems designers, the professionals concerned with information, need to be able to impose structure on the information in order to gather it into their systems, and therefore need to treat information as an object and to create a systems view of information (Rowley, 1998).

The system is a network of interconnected procedures, gathered together to carry out activities or to carry out certain targets (Hutahaean, 2014). The system connects every element that exists to achieve certain goals. While a piece of system information is a collection of hardware, software, data, people and procedures designed to generate information that supports the day-to-day, short-range, and long-range activities of users in an organization (Sharma & Thakur, 2015).

Information system is exactly giving simplicity and swiftness on business process in each organisation. So, it deservedly if information system had already applied on various sector, like healthiness, academic, government, entrenchment, disaster, and another sector.

Lindell (2014) about his journal article talk about tsunami titled “*International Journal of Disaster Risk Reduction*” explained that the important and the main key to overcome disaster is a warning or information about the disaster itself.

RESEARCH METHODOLOGY:

There are 3 steps in this methodology to develop disaster anticipation information system for Mount Merapi: (1) Planning; (2) System Design; and (3) Implementation / System Development. This article specifically discusses system design for Disaster Anticipation Information System.

Planning:

The first step that must be done in developing the system is planning. At this stage intensive communication with all the organizational elements involved. In the process of planning the development of the disaster anticipation information system of Mount Merapi involved one youth organization called Karang Taruna

Bakti Mudal as the primary data source of the disaster anticipation system for Mount Merapi. The result of this planning process is a list of user requirements and architecture of the disaster anticipation system.

System Design and Development:

The design process is done based on the system architecture that has been developed. The design uses several diagrams: Use Case Diagrams, Entity Relationship Diagrams, Data Flow Diagrams, and UI design for the system. After the application process is done then the next step is doing the application development. The design and development of applications is done interactively until the system can meet the needs of users.

ANALYSIS AND DISCUSSION:

FLOW CHART:

According to the Cambridge Dictionary, flowchart means a drawing that shows the stages of a process or activity from beginning to the end using different shapes connected by lines. The plot system is going on a few processes that it will generate to a good research, so that the sequences will be understanding by the users easily.

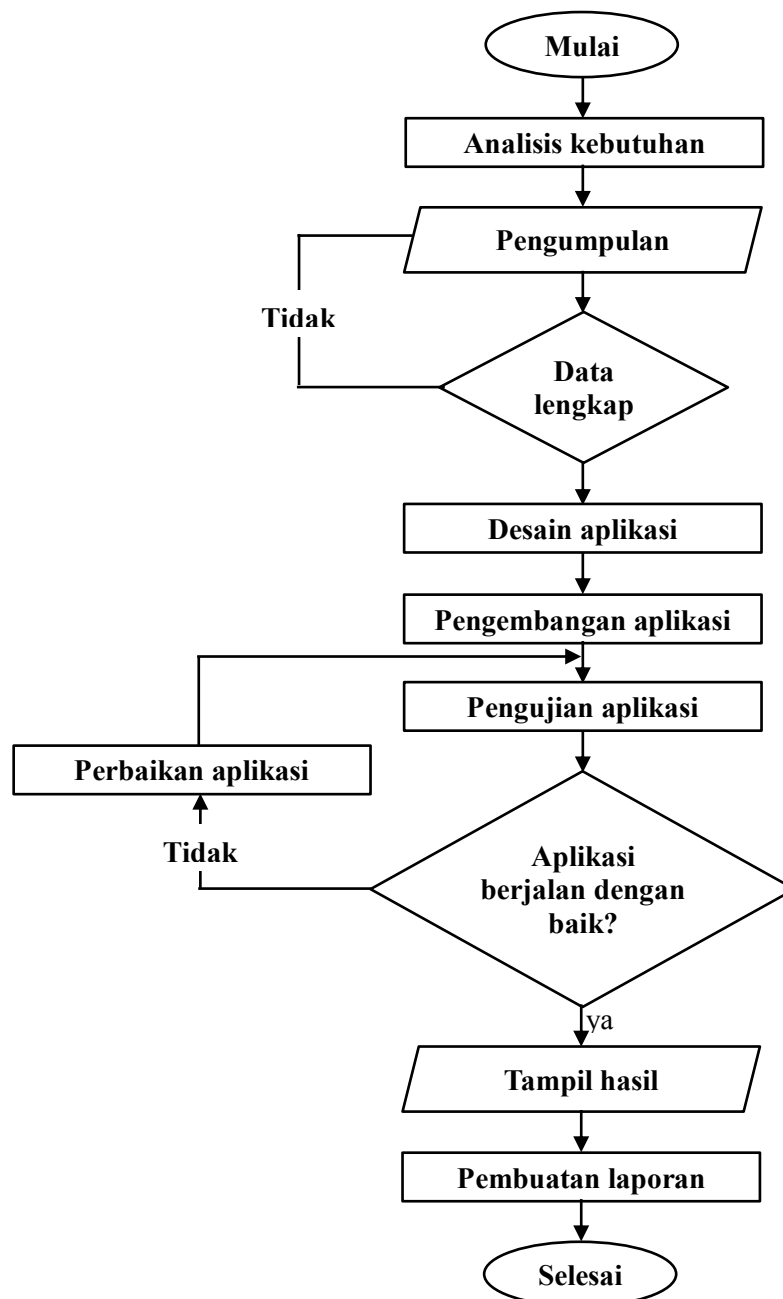


Figure 1: Flow Chart of the Creation of Anticipation Disaster Information System

DATA FLOW DIAGRAM:

The disaster anticipation information system was developed by applying android (*mobile*) programming. This data flow diagram explains about the data flow that used in this disaster anticipation information system. This data flow divided into 2 level, those are level 0 and level 1. Data flow diagram level 0 will explain the data flow in general. Then, data flow diagram level 1 will explain the data flow in particular. In the beginning, system will check the current location of user that use this application. This current location of user will automatically be sent by user’s GPS. Then the system will show the safe location that place near the user’s location when disaster / eruption occurs. The system also gives user the route to the safe location (nearest safe location). Data flow diagram level 0 and level 1 of the disaster anticipation information system can be seen in the Figure 2 and Figure 3.

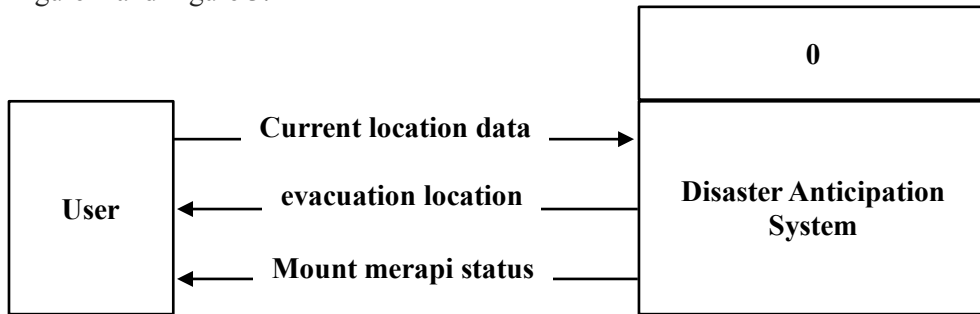


Figure 2: Data Flow Diagram Level 0 on Disaster Anticipation System

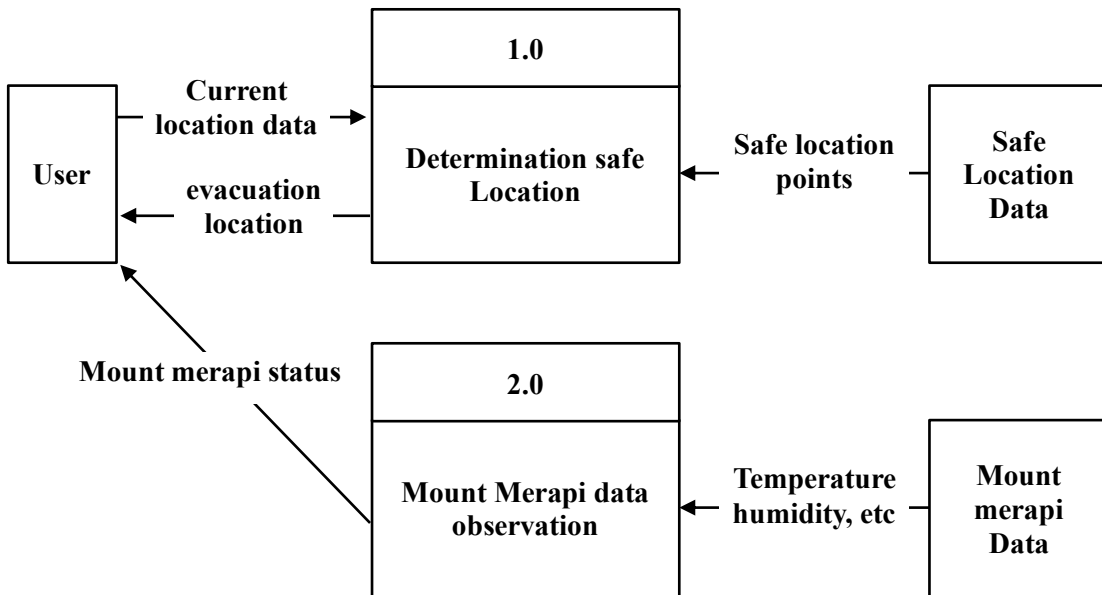


Figure 3. Data Flow Diagram Level 1 on Disaster Anticipation System

USE CASE DIAGRAM:

Use Case Diagram is a diagram that describe the interaction of the users and the system and what each user can do. In the disaster anticipation information system of Mount Merapi there are 3 main actors namely Application Admin, BPPTKG Admin (external admin) and User itself. The main difference between them are the ability to access the database on the system. Application Admin has access rights to several table on the system while the BPPTKG Admin can access data related to Mount Merapi. Use case diagrams for the disaster anticipation information system can be seen in Figure 4.

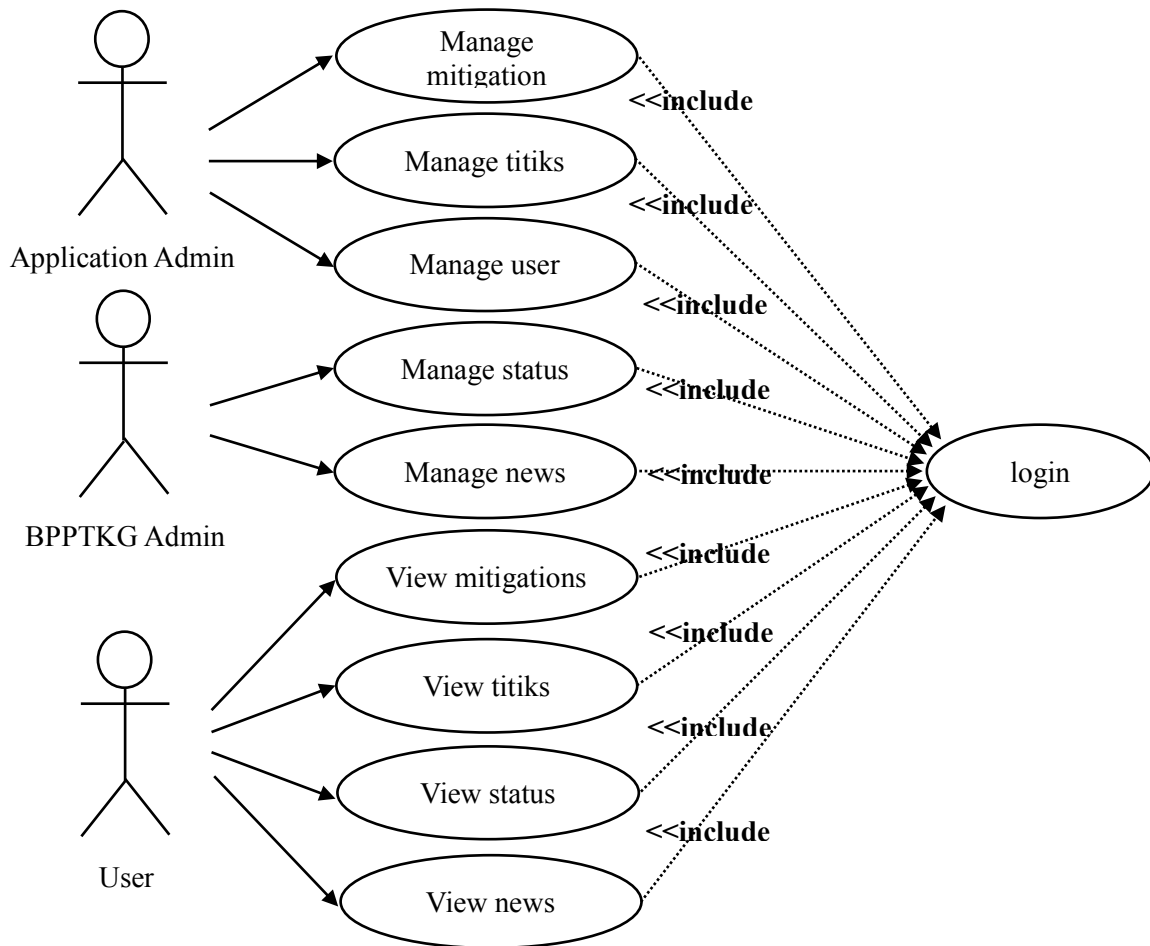


Figure 4: Use Case Diagram for Antisipation of Disaster Information System

ENTITY RELATIONSHIP DIAGRAM:

This system has four tables. Those tables do not have relation or dependence each other because the tables on system are designed that they haven't relation. Later, it will be displayed on an mobile application. This system does not have any classification of the table type. The table is created just for mobile system view, so it will look efficient on system.

The first table is Titiks's Table. It has longitude, latitude, name, and status as the attributes of this table. The table will save evacuation points around Merapi Mountain and the points are getting from Sleman Disaster Management Agency (BPBD Sleman). Next, there is users's table that contains of name, email, and password which is those attributes will save user's privacy who used this application. Third, the Status's Table. This table will keep the Mount Merapi's status latest, like "Alert", "On Guard", etc. The last table is Mitigasis's Table. This table will keep mitigation tips on facing the disaster, especially in Merapi Mountain. Those table has drawn on Entity Relationship Diagram that can be seen in Figure 5.

Titiks		Users	
PK	<u>id</u>	PK	<u>id</u>
	Longitude Latitude Name Status		Name Email password

Titiks		Users	
PK	<u>id</u>	PK	<u>id</u>
	Status		Judul isi

Figure 5: ERD of Antisipation of Disaster Information System

USER INTERFACE FOR DISASTER ANTICIPATION INFORMATION SYSTEM:

Website Display:

Home Page:

Home page is the first page that shown on website when it got accessed. This website used to data processes and then it will be shown on android system or mobile (server site).



Figure 6: Website Display of Anticipation Disaster Information System

Mobile Display:

Home Page:

Home page is the first page that shown on mobile application when it got accessed. In this page, it will give the user about Merapi mountain's status latest and news about Merapi Mountain.

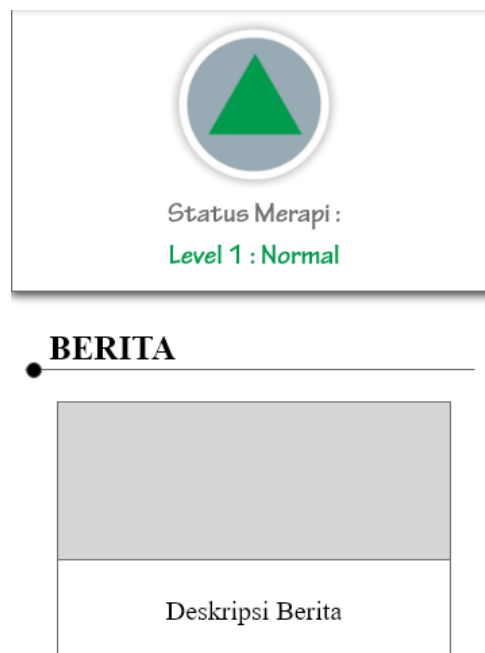


Figure 7: Mobile Application Home Page

Login:

Login page necessitates users to use their Google account to log in to this application. It aims that users are verified properly. Below is the outward of login page

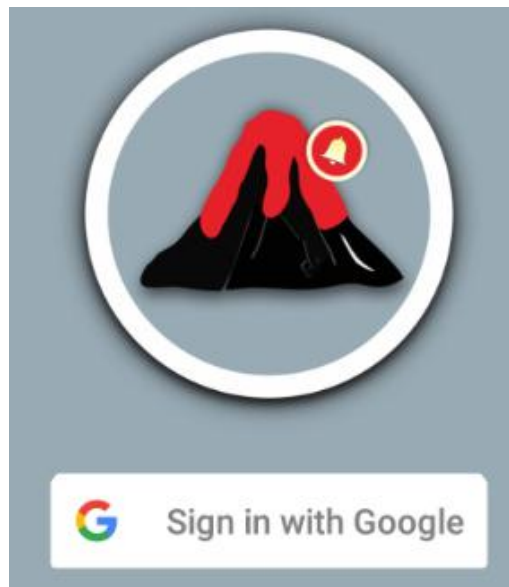


Figure 8: Login Page on Mobile Application

Side Bar Menu:

Side Bar Menu contains of menus that can be accessed by the user.

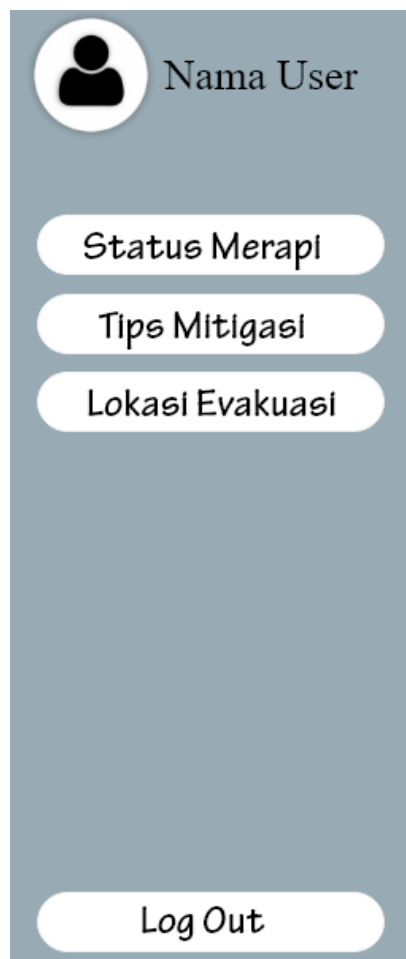


Figure 9: SideBar Menu

Navigation:

Navigation the feature is a feature that shows evacuation place direction or saves points around the users when the eruption happens.



Figure 10: Navigation Feature

Berita:

This application is given information about Merapi Mountains from news feature. Below is the outward of news feature

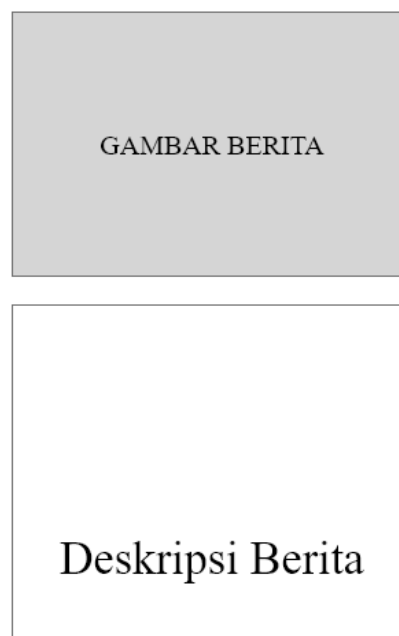


Figure 11: News's Feature on the Application

CONCLUSION:

Based on the design of Anticipation Disaster Information System compiled then it can be formulated some of the following conclusions:

1. The design of Disaster Anticipation Information System developed includes flow charts of the creation of anticipation disaster information system, data flow diagram, use case diagrams, entity relationship diagrams, and user interface design of Disaster Anticipation Information System.
2. The Disaster Anticipation Information System has a client-server model. The website is being server side and the mobile application being client side.
3. The Disaster Anticipation Information System has 3 main users. Those are the Application Admin, BPPTKG Admin, and the user.
4. The system database consists of 4 tables that have no relationship.
5. There are 2 levels in the data flow diagram of Disaster Anticipation Information System.
6. This information system application will show evacuation location data or evacuation points that nearby from users in Merapi Mountain's district. It is also showing the fastest route to go to the current location that is saved so that people can get information about evacuation location fastly and efficiently.
7. This application also is given Merapi Mountain's status update, recent news, and mitigation tips on tackling disaster in Merapi Mountain.

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