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# E-Trip : Mobile Application of Map Integrated for Post-Disaster Relief Needs

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***Abstract***

*Disasters have become a threat to every citizen in this country. The government is responsible for protecting residents by evacuating victims, repairing damaged roads and building infrastructure as well as distributing logistics through the National Disaster Management Agency or BNPB. The goal is to provide a safe life for citizens. After a disaster occurs, the government through BNPB must immediately respond to location information to save lives and help victims. So that information can be sent quickly from information sources and received by the government, a reliable geographic information system is needed. The function of this information system will be to provide top management support to make decisions. An Android-based integrated GIS will serve as a guide for post-earthquake, flood and landslide action services by building collaborations for victim data collection and road and bridge infrastructure with the National Disaster Management Agency, Community Health Centers and private and private hospitals. This development will apply the latest technologies such as Data Warehouse, Big Data, Data mining, machine learning, knowledge management, Decision Support Systems and so on that handle structured and unstructured data. The development of an information system will be built on a smartphone application by digging information on the location of Indonesia's earthquake victims from social media.*

***Keywords*** *– floods; Post Disaster map; e-Trip by smartphone*

## I. Introduction

Indonesia is a country prone to natural disasters such as earthquakes, landslides and floods. The natural disaster that occurred resulted in the destruction of road infrastructure such as the interior of Papua (kompas.com. 26 February 2018). The Lombok earthquake and the Donggala earthquake, Central Sulawesi (Kompas 28 September 2018). The road damage caused the disaster area to be isolated and it was difficult to get assistance because of the difficulty in identifying the affected locations. In addition, the road covered with mud becomes the next problem to find alternative roads to reach the desired location. Flooding is a condition of the water that submerges or inundates a large area or place. There is also a defining flood as an overflow of water that exceeds the standard capacity due to continuous rain[1,2]. There is a possibility that flooding can cause loss of life, the emergence of various types of germs, lack of clean water sources, destructive nature such as trees, plants, soil humus layers, and damage to property such as houses, bridges, facilities, and infrastructure of public facilities [3]. A damaged road can also mean impassable or even lost in the mud. To find the real road and alternative roads, it is very much determined by data and information that can be obtained quickly and accurately, including the availability of road information service support that is oriented to locations on the earth's surface (spatial data) with attached information (non-spatial data). more comprehensively. Furthermore, data and information can be used as a reference in planning the road network in an area as well as general regional

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spatial planning and post-disaster maintenance. This GIS-based information system must provide operator convenience without the need for re-entry of data that has already been inputted. With the integrated spatial and non-spatial data, it is hoped that the data will be free from redundancy and up to date. Data integration makes data dynamic because it accommodates changes in data quickly and accurately in a system, namely a geographic information system. Geographic Information System (GIS) is defined as a computerized database management system for obtaining data, collecting data, reprocessing, transforming and analyzing as well as displaying objects both spatially and in tabular form. Furthermore, GIS information will be presented through an application on smartphones that can be used unlimitedly by space and time because smartphones technology continues to thrive with the addition of features which make the device multifunctional[4] .

## 2. Research Methodology

### 2.1. Information System

Everything that is integrated in the form of inputs, processes, process tools and procedures to produce something that can be accepted by the recipient. The information system has accurate, valid, always new and useful results for the recipient. Along with the development of technology, the information system is supported by better technology so as to produce quality information.

### 2.2. Web

Web is a series of pages that one progressively navigates through [5]. Web is a collection of hypertext pages that offer information and links on trillions of pages. Web search engine is a tool that produces search results based on the user given query. World Wide Web (WWW) is a huge reservoir of Web-pages. Search engine crawler crawls down the Web-pages from WWW and creates a database of Web resources for the search engine[6]. According to Irwansyah "web is a collection of pages that provide information. Web browsing is the web browser used to open a web page. Now, there are many web browsers that can be used to browse in cyberspace such as google chrome, safari, Mozilla firefox, opera, and others[7].

### 2.3. Android

Android is a mobile operating system developed by Google. It is based on modified versions of the Linux kernel and other open source software, and is designed primarily for touch screen mobile devices such as smartphones and tablets. Android is the same as the Symbian operating system on Nokia, iOS on Apple and BlackBerry OS used on smartphones and tablet PCs. Android can also be referred to as an operating system for low-power devices that runs on batteries and is full of hardware such as Global Positioning System (GPS) receivers, cameras, light and orientation sensors, Wi-Fi and UMTS connectivity and touchscreens. Furthermore, the Android operating system allows applications to use hardware features through abstraction and provides a defined environment for applications [8].

### 2.4. Geographical Information Systems

GIS is a GIS application or digital mapping that utilizes the internet network as a communication medium that functions to distribute, publish, integrate, communicate and provide information in the form of text, digital maps and perform analysis and query functions related to GIS through the internet network [9]. GIS is a set of organized functions that provide experienced professionals for the purposes of storing, retrieval, manipulation and display of results based on geographic-based data [10]. Geographic information systems have data consisting of two components, namely spatial data and attribute data. In the opinion of

Peter A. Burrough [11] states that a geographic information system is a set of components that are carried out manually or computer-based which are the procedures used for storing and manipulating geographically referenced data. GIS can be broken down into several sub-systems as follows:

a) Input data is used to collect, prepare, and store spatial data and its attributes from various sources.
b) Output data is used to display or generate output.
c) Data Management is used to organize spatial data and related attribute tables in the database system so that they are easy to recall or retrieve, update, and edit.

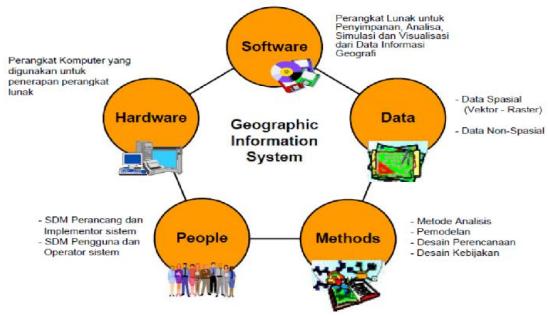


**Figure 1.** Components of Geographic Information System

d) Data Manipulation & Analysis serves to determine the information that can be generated by GIS. ArcGIS server is configured using the http protocol. Meanwhile, ArcGIS portal uses the http protocol to communicate. So to integrate ArcGIS portal with ArcGIS Server, ArcGIS server needs to be configured to be able to communicate via http protocol.

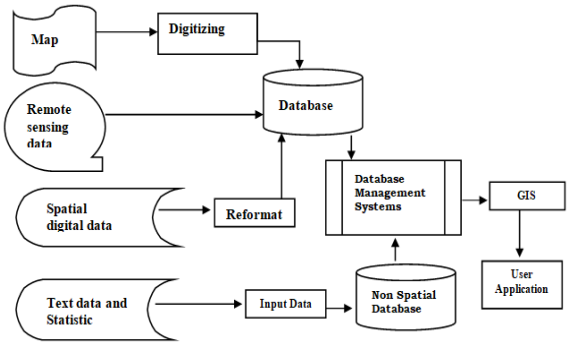


**Figure 2.** GIS Database Management

e) Relational Database Model
The most famous database model in DBMS is widely used in GIS. Some DBMSs that use the relational database model: Dbase(*.dbf) – used by ArcView, PC Arc/Info, INFO – Used in Arc/Info and Oracle – Used in Arc/Info, Geovision. The relational database model is a database model based on the first order logic formulated Edgar F. Codd in 1969 [12]. In the relational database model, all data is represented in the form of tuples, combined in relations. Databases that are organized in terms of the relational model are relational databases.

According to Ruslan Nuryadin, digital maps are representations of geographic phenomena that are stored for display and analysis by digital computers [13]. Each object on a digital map

is stored as a single or set of coordinates. Some of the advantages of using digital maps compared to analog maps (which are stored on paper or other printed media), include: 1. Digital maps are of constant quality. 2. Digital maps are easy to store and transfer from one storage medium to another. 3. Digital maps are easier to update. Editing for the purpose of updating data or changing the coordinate system, for example, can be more easily done using certain software. Digital maps can be represented in two models, namely raster maps and vector maps, each of which has the following characteristics:

**Raster Map:** Spatial data is stored in a matrix structure or a collection of pixels that make up a grid. Each pixel has a specific coordinate and resolution on which the accuracy of the map is based.

**Vector Map:** In a vector map model, spatial data is displayed, placed and stored as points, polygons, lines or curves and their attributes. In this model, a polygon, line or curve is an ordered collection of connected points. In a polygon, the starting point and the end point have the same coordinate values, so the shape is perfectly closed.

### 2.5. Map Server

MapServer (2005: 20) by Ruslan Nuryadin[13], states that digital maps have the following characteristics:Scale : The scale describes the level of detail of the object when the map is created. For example, on a 1:1000 scale map (1 cm on the map represents 1000 cm or 10 meters on the earth's surface). Geographic Reference : Geographic Reference in the form of reference ellipsoid parameters and datum. Map Projection System : Map Projection System determines how objects on the earth's surface are moved or projected on the map surface in the form of a flat plane. An example of a map projection is shown in the following figure:

## 3. Results and Discussion

To give a clear picture of e-Trip Mobile Application to monitor post-disaster locations, use cases class diagrams and diagrams are used to illustrate process flow and data used for it mobile application.

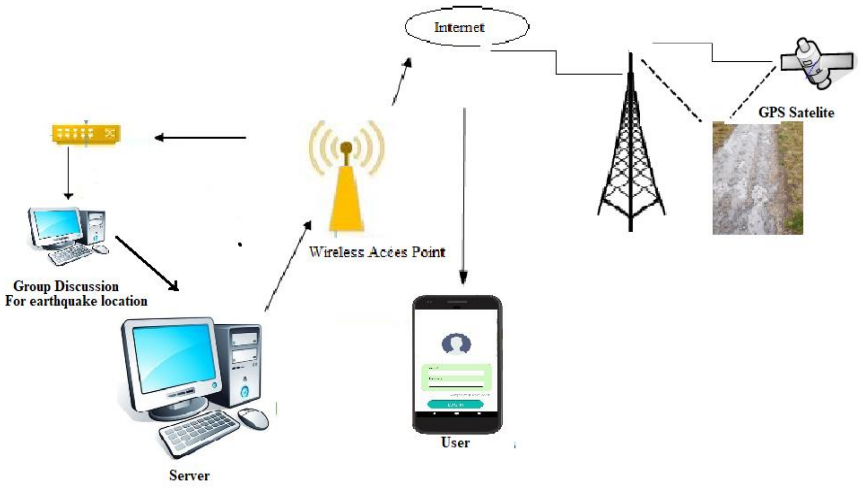


**Figure 3.** Gis based web and android

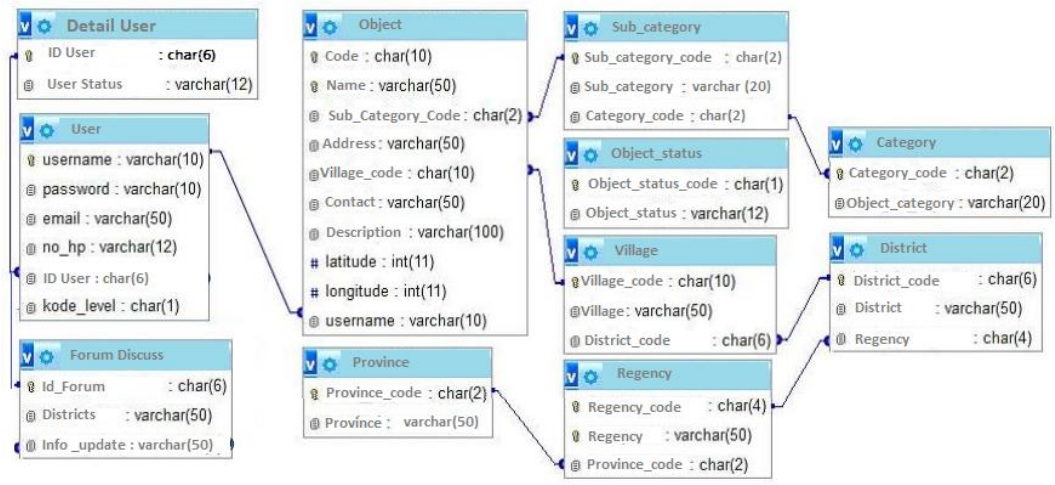


**Figure 4.** Class Diagram Database Design Model

Also, mobile user interface the app is displayed to show it is working. His design about our application. Our present the following diagram of application as can be seen in the Class diagram in Figure 4.

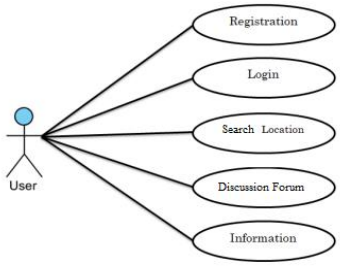


**Figure 5.** Use Case Diagram

In figure 5, To explain some interactions between the user and the system. We can see there are five use case activities such as registration, login, choose a search location, Discuss Forum, and information. Next is the detail for the explanation for each use case activity.

**a) Registration and Login**

In figure 6, before the user using the e Trip application to monitor or to see the disaster location in Indonesia. They must be doing some registration as our regulation. Users must be filling some fields in the registration. User must input their Full Name, input their email and email must be valid or active, choose their location or in Bahasa as known as Wilayah, and the last is input their address to complete their registration. After all, the field is filled, they can submit to register their account in our application.

In figure 7, before user access or using our application, they must be login first. They must have an account to log in. They must input their email and password to log in. If they do not have an account, they can click sign up here to register their account as can be seen in figure 9.


**Figure 6.** Registration


**Figure 7.** Login

b) Search Location and discuss forum

In figure 8, we can choose our location that we want to know about the real damage as road or bridge and the other infrastructure. We must input our location first based on our location or in Bahasa known as Wilayah, Kecamatan, and Kelurahan. Users can be known about the data after they input their location.

In figure 9, we can discuss with a group member to data update. On the discussion forum we can post the latest pictures on the disaster site. the latest image will be a guide for visitors who will provide assistance. Furthermore, the latest images can also be used by the government as a reference in improving infrastructure.

**Figure 8.** Search location


**Figure 9.** Discuss Forum

c) Information

The information menu displays the latest infrastructure conditions along with assistance services to guide visitors to the location in the form of road routes, vehicles that can be used and the needs of disaster victims.


**Figure10.** Information

## 4. Conclusion

The application of geographic information system mobile applications will help disaster management agencies as well as government and medical personnel to provide assistance during disasters and after disasters. Meanwhile, disaster-affected residents can provide information about the location of the disaster and disaster victims. Furthermore, disaster victims can also get information about the arrival of the medical team who will evacuate them. Meanwhile, based on the forum discussion, the admin can change the route of the location so that it is easy to reach and can then be used as an alternative route. With this geographical information system, disaster management agencies and the government can get information about impassable roads, damaged bridges and look for better alternative routes so that aid can arrive where it is needed. The use of this mobile GIS application can avoid location errors affected by the earthquake and faulty locations of damaged infrastructure for further repair. In addition, the use of GIS technology can support government programs in repairing damaged infrastructure. In the future, the mobile GIS application will be expanded to other activities such as monitoring infrastructure that is directly related to the nearest health post and installation of lighting, water sources and medical personnel on duty.

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