Integrated Web Based Information System with Short Message Service (SMS) Gateway for Natural Disaster Preparations: Case Study in Kediri Region, East Java Indonesia

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Abstract: Geo graphics Information System is a system that can be used to collecting, manipulating and analyzing information of geo graphics. This technology does not only function as a tool maker of digital maps, but capable of producing a system used for the planning, geographical data analysis and decision-making. Based on geographical location and geological, Indonesian is one of a country often experienced disasters. There for needed a technology that could help in handling the disaster. One of the technology needed for the handling of disasters namely by utilizing geo graphics information system. The process of making geo graphics information system using software PHP, database MySQL and Google maps. Besides comprising mapping prone to disaster, system to be made it may help a quick reaction team for information disaster that was going on in an area, that a team quick reaction be able to come to the residing and do study data. By using with global positioning system village officials (user who given the access) to send information about disaster that was going on in the area, so that data it can be processed by admin to disaster mitigation.

1 INTRODUCTION

Geographically Indonesia lies in two oceans namely Indian Ocean and Pacific Ocean, located in the tropics which is an area crossed by the equator. The influence of geographical location makes some areas of Indonesia have a constantly changing weather. Geologically, Indonesia lies on three tectonic plates, these plates often experience friction. As a result of geographical and geological location of Indonesia that resulted in frequent floods of Indonesia, droughts, landslides, earthquakes, tsunamis, volcanoes and so forth. One of the disaster-prone areas of Indonesia is East Java, which has 13 volcanoes, is passed by a Bengawan solo river, there is a vast forest and is in a tropical region that makes East Java vulnerable to disasters, especially the Kediri region (Geography, 2018).

Kediri region flanked by two different mountains, namely mount Kelud in the east that is volcanic and mount Wilis in the west that is non volcanic, it makes the Kediri area prone to volcanic eruptions, landslides and cold lava floods. Based on the topography condition, there are eight areas that are prone to landslide and flood disaster. Areas that enter the vulnerable zone are located in the area around the slopes. Eight prone areas include Mojo, Semen, Banyakan, Grogol, Tarokan, Kepung, Puncu and Kandangan sub districts (Geography of Kediri regency, 2018).

Based on the topographic condition of Kediri region, there have been occurrences of natural disaster, one of which is the eruption of mount Kelud on Thursday 13 February 2014. Its impact covers Kediri and its surroundings. Based on Indonesian disaster data and information obtained from dibi.bnpb.go.id, the disaster was recorded 39018 residents of Kediri to evacuate [9,11,12]. At that time the signs will erupt so quickly, that the villagers are less prepared to face the eruption. From the event there should be a system that provides a picture of the

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disaster and how to deal with it both before and after the disaster.

The existence of disaster-prone areas of the district and city of Kediri and based on the disaster event, need a technology that can assist in disaster mitigation [9,12]. Disaster mitigation is an effort to anticipate or cope with disaster after disaster or before disaster (Puturuhu, 2015).

In the research of Mustopa Ali et al (Ali et al., 2015) produce analysis of Geographic Information System (GIS) for the earthquake disaster integrated in Special Region of Yogyakarta. The research produced a new system design of the old system. The study was conducted with several steps, namely the old system analysis and formal documentation used in system development. Then analyze the system requirements and make technical documentation of the main system design and standard rules of system development.

From research Munir and Agus Qomaruddin (Munir et al., 2014) produced a technology that is Geographic Information System (GIS) Mapping of Natural Disasters Using Google Maps. The Information System utilizes Google Maps which is a free online mapping service provided by Google. Google Maps itself provides an API of one form of java script library to access this geographic information. With web API the programming can build its own web which features GIS with the help of Google Maps (Roesdiana et al., 2014),(Google Maps, 2018).

In this study, researchers used web based information system and geo graphics information system (GIS) to generate a system useful for mapping disaster prone areas, managing news portals containing current disaster news, managing disaster information data going on, and managing disaster preparedness articles. So hopefully this system is beneficial to society and agency of related institution (Disaster Data, 2018).

2 MATERIALS AND METHODS

In solving a research required a research method, in order to produce a study that really maximal. The approach used refers to the rules of the development cycle of a soft ware. In this research using Waterfall Method approach (Understanding ERD and DFD, 2018). The details of the troubleshooting approach are described below at figure 1.

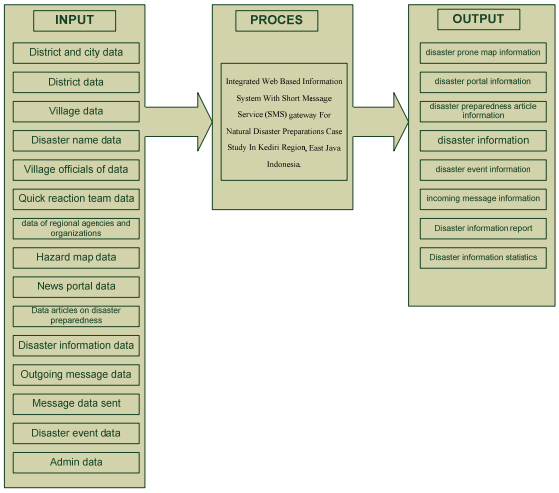

Figure 1: Block Diagram.

2.1 System Analysis

At this stage an analysis of the system needs. Needs analysis is done to collect information about the needs of users of the system and analyze the elements required by the system. From the results of system analysis obtained the need for data to support this system that is the data of disaster prone areas of the district and city of Kediri. The data is used to make system design and then built the system (Analysis of information system design, 2018).

The data is obtained based on sampling criteria that is determined, namely the district and city of Kediri obtained from Regional Disaster Management Agency East Java Province. The data were collected by observation and interview.

2.2 System Design

At this stage modeling the system by describing the process and the flow of data that is going on to produce a detailed conceptual picture of the Disaster Preparedness Information System district and municipal district Kediri web based.

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2.2.1 Tiered Diagram

The tiered diagram of the Disaster Preparedness Information System of Kediri district and municipal areas based on the web can be seen on the picture shown on the figure 2.

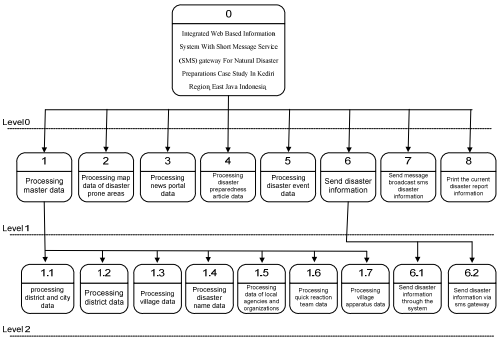

Figure 2: Tiered Diagram.

2.2.2 Data Flow Diagram (DFD)

Data Flow Diagram compiled as a tool that is useful for the preparation and design of Information Systems in a structured, while the advantage is to facilitate users who lack the computer field to understand the system worked or developed (Understanding ERD and DFD, 2018).

2.2.3 Data Flow Diagram (DFD) Level 0

Data Flow Diagram level 0 from Disaster Preparedness Information System of Kediri district and municipality area based on web can be seen on the picture which is listed on the figure 3.

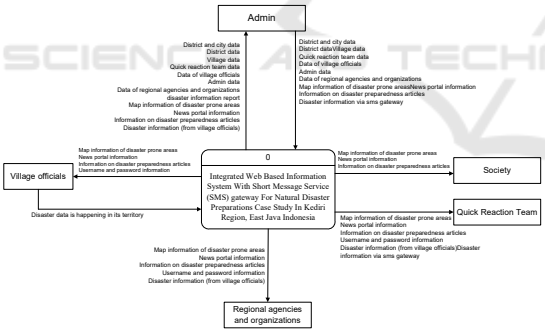

Figure 3: Data Flow Diagram (DFD) Level 0.

2.2.4 Data Flow Diagram (DFD) Level 1

Data Flow Diagram level 1 of Disaster Preparedness Information System Kediri district and municipal area based on the web can be seen on the picture shown on the figure 4.

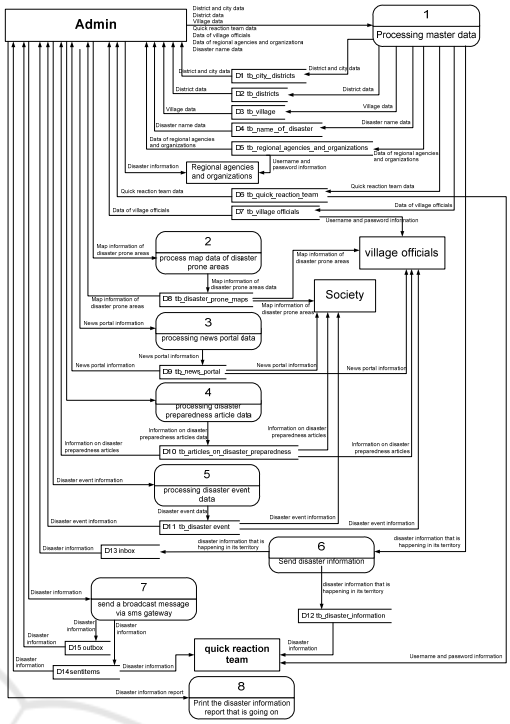

Figure 4: Data Flow Diagram (DFD) Level 1.

Data Flow Diagram level 1 process master data from Disaster Preparedness Information System Kediri district and municipal areas based on the web can be seen in the picture shown on the figure 5.

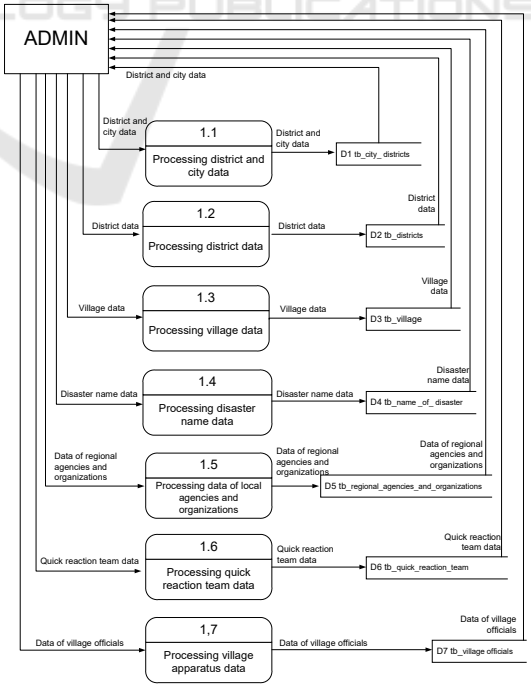

Figure 5: Data Flow Diagram (DFD) Level 1.

2.2.5 Data Flow Diagram (DFD) Level 2, Sending Disaster Information

Data Flow Diagram level 2 send disaster information from Disaster Prevention Information System Kediri district and municipal area based on web can be seen in the picture shown on the figure 6.

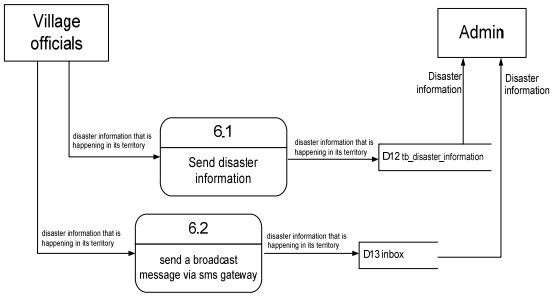

Figure 6: Data Flow Diagram (DFD) Level 2, Sending Disaster Information.

2.2.6 Entity Relation Diagram (ERD)

Entity Relationship Diagram (ERD) describes the relationship between data in the database by using symbols, where the attributes of an entity have relations (relation) with attributes on other entities. The description can be seen in the figure 7.

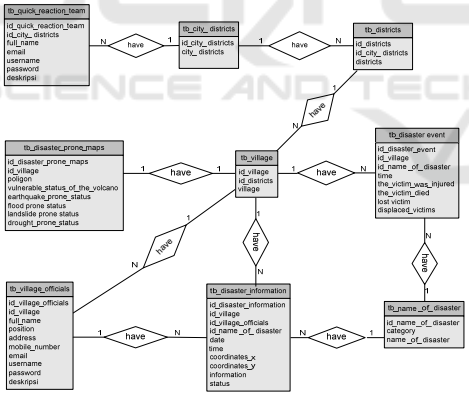

Figure 7: Entity Relationship Diagram (ERD).

2.3 Mapping

The process of mapping between tables is a combination between tables that have the same primary key, so the tables become one unity connected by the key field. In this process the data elements are grouped into one database file along with the entities and their relationships (Understanding ERD and DFD, 2018). The description can be seen in the figure 8.

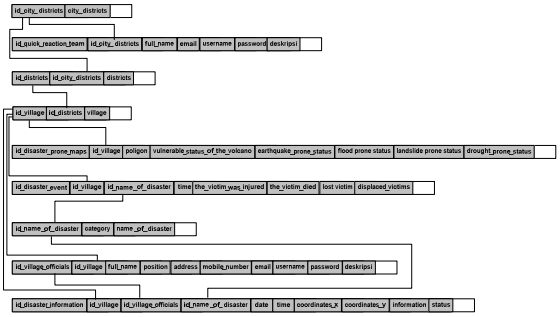

Figure 8: Mapping.

2.4 Interface Design

System Development At this stage the implementation of the results of analysis and system design. What is done in this stage is system creation, input interface and output software.

2.4.1 System Trial and Evaluation

This stage is the final stage of the development of Disaster Preparedness Information System of Kediri district and municipality. At this stage a system test has been established and followed by evaluation of the advantages and disadvantages of this system.

2.4.2 System Development

Implementation of the program is the stage where researchers apply or install software that has been created and tested against all system functions. By considering the consequences and following the stages in the Waterfall method well then the opportunity to get a quality system will become bigger.

3 RESULTS

3.1 User Interface and Implementation

The following is the user interface and system implementation on Disaster Preparedness Information System Kediri district and municipal areas web based:

3.1.1 System Implementation at Admin

Implementation of system at admin consists of 10 menu that is home menu, data master menu, disaster prone map menu, news portal menu, disaster preparedness menu, disaster information menu, SMS Gateway menu, disaster event menu, report and

statistics menu, and admin data menu (Habib et al., 2016).

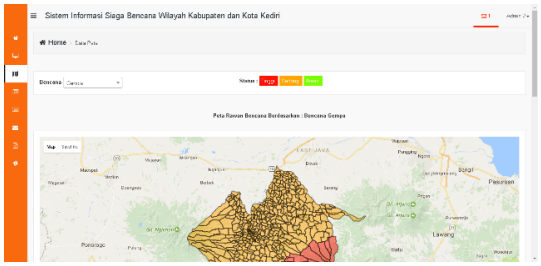

Figure 9: Map Prone to Disaster Menu.

Figure 9 is a disaster prone map menu containing disaster prone areas data, on the menu admin can only change the status of disaster prone and change the polygon map. In the menu there is no "Delete" and "Add" buttons because the data on the disaster prone map is automatically increased or erased if the data in the village increases or deletes.

The news portal menu contains news portal data from the database. In this menu consists of tables containing news portals, "Add" button to open the add form, "Edit" button to open the edit form, and "Delete" button to delete the data.

The news portal menu contains news portal data from the database. In this menu consists of the Disaster Preparedness Menu containing disaster preparedness data articles from the database. In this menu consists of tables containing disaster preparedness article data, "Add" button to open the add form, "Edit" button to open the edit form, and "Delete" button to delete the data.

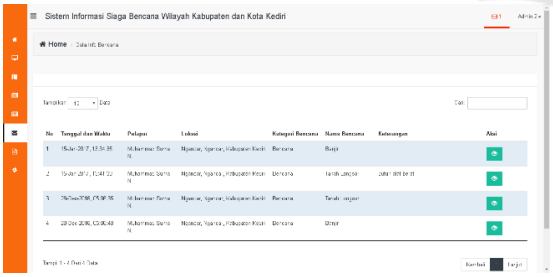

Figure 10: Disaster Information Menu.

Figure 10 is a disaster information menu containing disaster information data from village apparatus reports. In this menu there is a button to go to Maps Directions form to disaster location by utilizing google maps API and GPS.

Figure 11 is the Maps Direction page to the disaster location by using GPS.

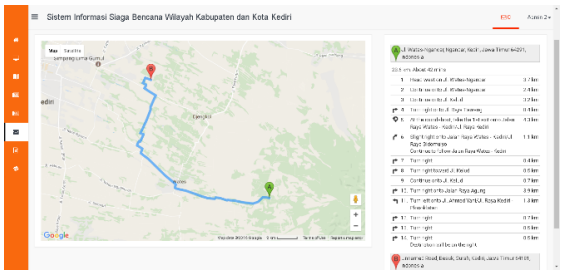

Figure 11: Directions to Disaster Locations.

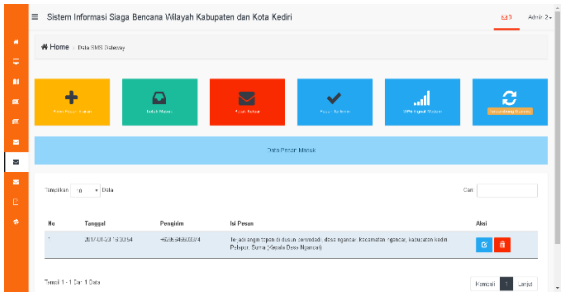

Figure 12: SMS Gateway menu.

Figure 12 is a menu on SMS Gateway (SMS Gateway Visual Basic, 2018). The menus include sends broadcast messages used to send disaster information messages to disaster response teams, inbox menus containing incoming message data disaster information from village apparatus, outbox menu containing outgoing message data that has not been sent or pending, sent message menu containing sent message data, modem signal menu shows how many percent of modem signals, Gammu's connected menu shows whether your Gammu service is disconnected or disconnected.

The Disaster reports and statistics menu contains a sub menu of disaster information reports and disaster information statistics. Disaster information report sub menu to display disaster information report based on date and year and sub menu of disaster information statistics to display pie chart of disaster information statistics.

The Disaster reports and statistics menu contains a sub menu of disaster information reports and Figure 13 above is a page that contains disaster event data from the database. On the page there is a table that contains the disaster event data, the "Add" button to open the form added data, the “Open” button to open the edit data form, and “Delete” button to delete the data.

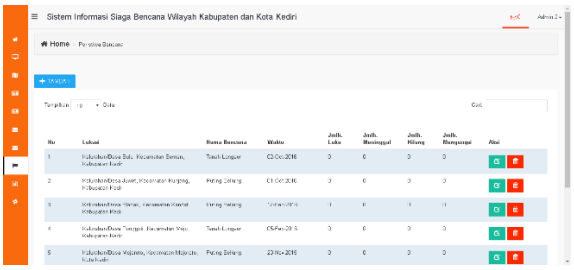

Figure 13: Sub Menu of Disaster Information Report.

Figure 14 is a sub menu of disaster information reports there is a "Process" button to process or display reports based on month and year input data, "Print" button to display the print ready page of disaster information report.

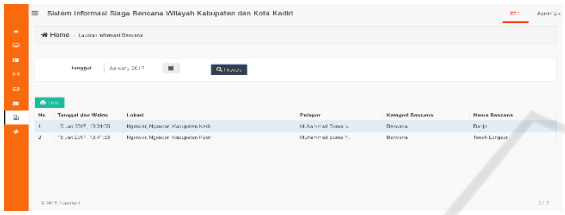

Figure 14: Sub Menu of Disaster Information Report.

Figure 15 is a sub menu of disaster information statistics containing disaster information statistics in the form of pie charts.

The admin menu contains admin data and this menu is used to add, modify and delete admin data.

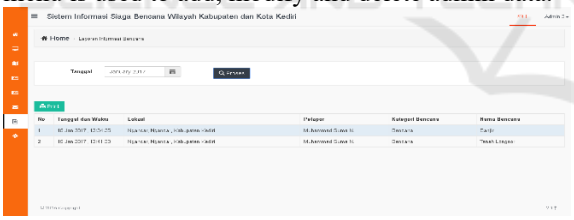

Figure 15: Sub Menu Disaster Information Statistics.

3.1.2 User System Implementation

The implementation of the system provides users with news portals, disaster preparedness articles, disaster prone maps, emergency response facilities to transmit existing disaster information sent by village officials and disaster information facilities that can be utilized by disaster response teams, local agencies and organizations. Figure 16 is a user's home page containing a map of disaster-prone areas, the latest disaster news and disaster information going on (Function and duty BPBD East Java Province, 2018).

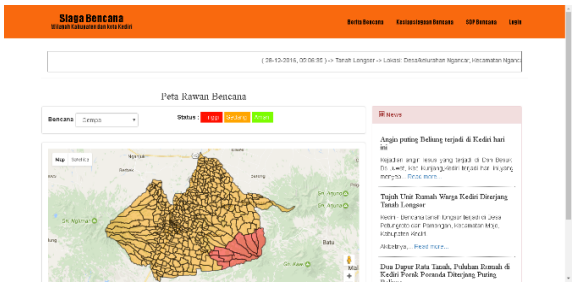

Figure 16: Home page.

Figure 17 is a page that contains a collection of disaster news.

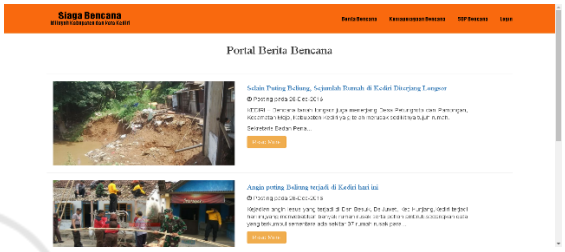

Figure 17: News List Portal page.

Figure 18 is a page that contains a collection of disaster preparedness articles.

Figure 18: Disaster Preparedness Articles Page.

Figure 19 is a page with a full description of the news portal.

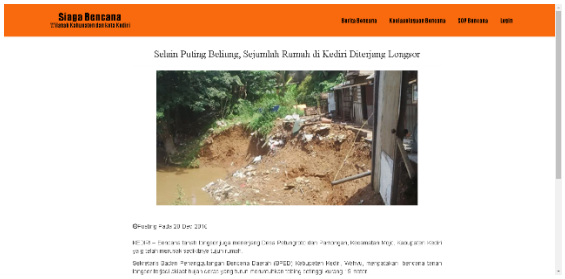

Figure 19: Content Fill News Portal.

Figure 20 is a page with a full description of disaster preparedness articles.

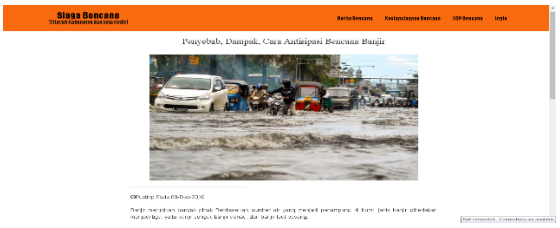

Figure 20: Page Contents Articles Disaster Preparedness.

Figure 21 is a page that contains information on disaster reporting information procedures to the system.

Figure 21: Page Standard Operating Procedure for Disaster Management.

Figure 22 is a page that contains disaster reporting forms to the system in the event of a disaster. When the village apparatus users successfully log into the system then it will automatically open the page, then the village apparatus chooses the name of the disaster, enter the information when necessary and press the "Submit" button.

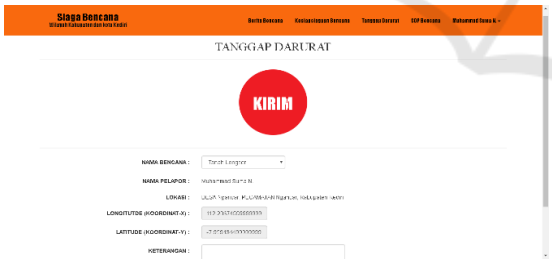

Figure 22: Emergency Response Page.

Figure 23 is an alert that contains information that a failure occurred in sending disaster information because the coordinate data is still empty.

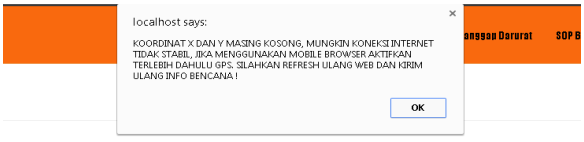

Figure 23: Alert Failed Load Coordinate Data.

Figure 24 is a page that contains disaster information data. This page can only be accessed by rapid response teams, and local agencies and organizations. On this page is a "View" button to open the maps page direction to the location of disaster information.

Figure 24: Disaster Information Page.

System testing is an important part of the software development cycle. Testing is done to ensure the quality and also know the weakness of the software. Testing on this system using black box method. Black box testing is done by testing whether the system developed in accordance with what is contained in the functional specifications of the system.

4 DISCUSSION

After the planning and making of the system, then in this research will be followed by the discussion of the results of implementation and trial of the disaster preparedness information system of Kediri district and municipality of Kediri web based. To test the system, it takes some support system (Roesdiana et all., 2014).

4.1 Supporting the Application Program

Prior to the implementation and testing of the system built, previously required installation process support system, including.

4.1.1 Hardware

The hardware available to test the system includes :

1. Intel Inside Core i5 2.40 GHz processor
2. 4GB DDR3 Memory
3. 500GB hard drive
4. 14 inch monitor
5. Modem Prolink PHS600.

4.1.2 Software

Required software such as:

1. Microsoft Windows 7 Ultimate operating system
2. Xampp Version 1.8.3 Control Panel v3.2.1

3. SQL database version 11.11
4. Google Chrome version 55.0.2883.87

5 CONCLUSIONS

Based on the result of the research, it can be concluded that the disaster preparedness information system of regency and municipality district can help the community and Regional Disaster Management Agency in the event of disaster.

This system is equipped with GPS to assist the ongoing disaster reporting so that when pressing the "View" button on the disaster information data, it directly shows the route of the map to the disaster location using the facility in Google Maps API.

It is expected that this system can be developed based on android and there are additional donor facilities and volunteers and the process of sending the results of disaster data assessment from the rapid reaction team.

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