Information System for Disaster Mitigation Using Google Data Traffic

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Abstract. The Head of the Data Information Center and Public Relations of the National Disaster Management Agency predicts the potential for forest fires in 2018 will increase. The areas that are burned are border areas, both provincial/district/city borders because border areas are poorly supervised. This study aims to (1) Develop an Information System that can be used for Disaster Mitigation Using Google Data Traffic (2) Ensure that the developed Information System is suitable for use for Disaster Mitigation Using Google Data Traffic to obtain accurate traffic data. Google Data Traffic is a giant database used by the Google company to provide real-time traffic information through the Google Maps application. Google Maps uses multiple iterations of satellite cameras and uses Google Earth to map traffic including congestion information and the shortest possible path alternatives. The development method chosen is the Rational Unified Process (RUP). This research uses several methods in data collection including observation, interviews, and questionnaires. Interviews were conducted with prospective users of the application, namely firefighter drivers and people in disaster-prone areas. Questionnaires are used to provide a set of questions to respondents. In the determination test, the recall and precision values are calculated from the data generated by the developed system. While the function test uses descriptive data analysis techniques with the percentage feasibility formula. This research produces an application that can assist firefighters in carrying out their daily duties to be more effective and efficient and the test results on this application show that it is declared feasible in terms of efficiency, performance and compatibility.

1. Introduction
The Head of the Information Data Center and Public Relations of the National Disaster Management Agency predicts the potential for forest fires in 2018 will increase. The areas that are burned are border areas, both provincial/district/city borders because border areas are poorly supervised. One of the primary causes of deforestation in Indonesia is fire. [1]. Forest and peat fires occur almost every year in Indonesia, with some fires causing significant damage. For example, the 1997/1998 fire incident, which is regarded as Indonesia's worst forest fire, destroyed more than 11 million ha of Indonesian forest. [2]. The number of hotspots causing forest and land fires in several parts of Indonesia has increased. According to a report by the National Disaster Management Agency (BNPB), based on satellite monitoring, the increasing number of hotspots only occurred within a week. Initially on July 27, there were only 173 points, and then it jumped to 239 points until Sunday, July 30, 2017. Six Sumatera and Kalimantan provinces (South Sumatera, Jambi, Riau, West Kalimantan, Central Kalimantan, and South Kalimantan) experienced extremely poor air quality as a result of the haze, with PM10 concentrations exceeding 500 mg/m³ recorded at several measuring stations. [3]
Land and forest fires have had a wide-ranging impact, affecting not only transportation and health, but also wildlife habitat. Several Indonesian endemic, endangered species, such as the orangutan and the Sumatran tiger, are forest dependent; thus, forest degradation due to fires directly threatens their existence and indirectly contributes to their population decline. [4]. On the other hand, Information Systems in today’s modern era have a very important role in presenting information and become the backbone of almost all companies and organizations. Information systems are interconnected components that work together to collect, process, store, and disseminate information in an organization to support decision making, coordination, control, analysis, and visualization. [5]. For many researchers and engineers, the use of sensor networks to monitor natural hazards such as wildfires has become a special research topic. [6]. Of course, along with the advancement of internet technology, the information systems used today are computer-based. In addition, smartphone technology is also growing rapidly. So that people can access information systems not only through computers, but also through smartphones whose marketing is currently mushrooming in all circles of society. The advantages of smartphones compared to ordinary cellphones are that they have an operating system, web and internet applications, touch screens, and message processing features. Meanwhile, in Indonesia, the statistics of information and communication technology (ICT) adoption are more than promising. Internet penetration increased significantly over the last three years, from 15% in 2014 to 51% in 2017, making Indonesia the country with the highest growth in Internet users, more than five times the global average between 2016 and 2017.[7]

The role of Android phones is certainly very important in today’s daily life, both at home and when we work outside the home. The scope of location when using an Android phone is also wide, it can be at home, office or outside the office. Various kinds of features are offered in android mobile devices. Applications that use the internet as a navigation base are also widely developed by service providers with the aim of making it easier for every driver to find their way with the help of digital maps. Various kinds of features are also embedded in internet-based navigation applications, for example features to determine the level of congestion on a road. This feature can be used by all drivers to avoid getting stuck in traffic jams.

Meanwhile, to obtain accurate traffic data, the research team intends to use Google Data Traffic. Google Data Traffic is a giant database used by the Google company to provide Realtime traffic information through the Google Maps application. Google Maps uses multiple iterations of satellite cameras and uses Google Earth to map traffic including congestion information and the shortest possible path alternatives. The traffic flow we see on Google Maps is a very accurate real-time display of the number of Android phones currently available. All traffic data including roads, buildings, restaurants, motorcyclists and so on will be stored in Google Traffic Data.

IoT is defined by the International Telecommunication Union as a global infrastructure for the information society enabling advanced services by interconnecting things based on existing and evolving interoperable information and communication technologies [8]. There is a lot of interest in developing disaster management systems that can save lives and property while reducing the need for costly economic investments. In order to build an effective monitoring infrastructure, information must be gathered from a variety of sources. IoT technology has seen significant success in this context. [9]. In recent years, innovative real-time monitoring and disaster warning systems have emerged, based on the emerging IoT paradigm, in which things (sensors) are globally interconnected. WSNs have been widely used as part of the Internet of Things to monitor natural disasters in remote and inaccessible areas. [10].

Departing from the various backgrounds above, the research team felt the need to build an information system that can be used for disaster mitigation, especially fire disasters. This information system can be accessed through computers, laptops, and of course Android-based smartphones. Fire victims can immediately send requests for assistance through this system, so that their position can be immediately tracked by the system which will then be followed by the process of picking up and evacuating firefighters. This information system works by applying IoT technology. It is hoped that this system can help people who need emergency assistance and of course firefighters can also be more alert in picking up fire victims.
2. Discussion

2.1. Inception Stage
At this stage, observation and interview techniques were used. Researchers conducted interviews with several residents affected by the fire disaster in the Daerah Istimewa Yogyakarta and surrounding areas. The results of interviews with the following components:

1. Early report to related unit / fire service
   Reports from related parties in this case are fire service units, there are many cases of fires that occur but lack of fast information, so that fires cannot be handled properly. Meanwhile, this is only limited to using cable telephones that are used to related parties.

2. The length of time for firefighters to arrive at the location of the fire disaster
   The duration of the fire department is constrained because of the large number of motorized vehicles on the road, thus preventing fire engines from reaching the fire destination.

3. Stuck in a traffic light
   Due to the lack of coordination between related parties and the police, traffic light jams often occur which causes fire trucks to not arrive at the location of the fire on time.

4. Map of fire hazard
   The map will be there automatically showing where the fire occurred as well as showing the closest route to the fire scene so as to make time shorter and fires can be extinguished quickly. The results of observations and interviews are needs analysis in the form of specifications needed in the development of Fire Disaster Mitigation Applications.

2.2. Elaboration Stage
Figure 1 depicts how Google Traffic data was developed in detail. The Disaster Mitigation Information System Development System makes use of Backend Service Firebase services such as Realtime Database, Authentication, REST Support, Data Analysis, and SaaS Services [11]. The use of Firebase allows communication between the User and the fire department. The user interacts with the Disaster Mitigation Application system using an application on a smart phone. This application has several main features including (1) SignUp/Login (2) User verification (3) Fire disaster report (4) Upload Photos (5) Upload Location using GPS. Users can use this application together. The application will send updated vehicle location data to Firebase using an internet connection and a server that accommodates calculations in the cloud data by using the GPS found on the Smartphone [12].

![Fig 1. Disaster Mitigation Application System Design](image)

2.3. Construction

2.3.1. Firebase
The use of Firebase as a Mobile Backend as a Service is a step that helps researchers. Firebase as a service that provides various services in one place. There are 2 firebase services used in this research, namely Realtime Database and Authentication. The Firebase Realtime Database which is used as a
storage place for all data will be accessed by the user through the Fire Disaster Mitigation application and will be accessed by all application users together as shown in figure 2.

Figure 2. Dashboard Firebase

Firebase communication using android utilizes authentication and realtime database. In the development of Android-based Fire Disaster Mitigation, the firebase configuration is centered on one configuration file in the form of a google-services.json configuration file which must be downloaded on the firebase server and included in the android project. By using this configuration file, Smart Traffic Apps applications can interact with Firebase Services both Authentication and Realtime Database.

Figure 3. Firebase Configuration File

2.3.2. Android Application
Android-based Disaster Mitigation application was developed by using Android Studio software. In the development of Disaster Mitigation application that are connected to Firebase authentication and realtime databases function as Mobile Backend as a Service. The authentication service on firebase is used for account registration and user management systems. This service will handle user registration data and is used for system login. The smart traffic light application features an account registration and login system.
Figure 4. Android Studio

Realtime Database service as data storage base for communication bridge with smart sensor. The realtime database on firebase has a data structure in JSON (Java Script Object Notation) format as shown in Figure 5.

Figure 5. Firebase Database
The Disaster Mitigation application uses the digital map feature to search for travel routes. The digital map used is the Google Maps API V2 service which already supports programming in Android Studio. Android Studio uses the library 'com.google.maps.android:android-maps-utils:0.4+' to access services in Google Map API V2. The features used in this library include:

1. Travel Route Search
2. Determination of the ordinance of the travel route
3. Calculations rarely use point coordinates
4. Making a Marker Map
5. Displaying Google Map in Application

The Google Map API V2 is used by the Disaster Mitigation application to access Google digital maps via KEY. The key will be obtained after we register through a Google developer account and access the Google Developer Console page as shown in Figure 6.

Communication between The Disaster Mitigation application and Google Map API V2 uses a retrofit library. This library is used to read JSON data and parse information from JSON data. Firebase's Realtime database also uses the JSON format for its data storage.

2.3.3. Transition
The development and testing stages are included in the transition stage. The Disaster Mitigation android application, also known as the Disaster Mitigation application, was created with the help of the Android Studio software and the Java programming language. The Disaster Mitigation application has the following features:

1. SignUp, Login and Verify
2. Filling in and Details of User Profile info
3. Latest disaster info
4. Disaster Info Details
5. Disaster data input form
6. Photo upload form
7. Location search form using GPS

2.3.4. Application
Disaster Mitigation has a service for registering user accounts, this aims to make it easier to add application users. User account data and stored in MbaaS Authentication Firebase. The user must always be connected to the internet when using the Fire Disaster Mitigation application. When the Disaster Mitigation application is launched for the first time, the user is prompted to enter his or her login username and password, as shown in Figure. If the user does not have an account, the user can register through the account registration shown in the image below.
The main page of the Disaster Management Information System contains information on all user data required by the operator, such as name, address, email, mobile number, and the current position of the user. The user's location will always be monitored by the operator through the facilities provided by GPS. In this study, the researcher took a sample of user data from various location points to determine how fast the information was from the user to the operator.

The next page contains information about disasters that will occur in the near future, as shown in Figure 9, there was a flash flood in the city of Garut. The news is linked by software that is connected by the BMKG (Meteorology and Geophysics Agency) from all over Indonesia, the data is displayed on the page randomly.

The user profile on the next page will be displayed automatically if the user has been previously verified by the relevant operator. Disaster Management Information System is a system that combines Android Application with Hardware Embedded System. The hardware embedded system referred to in this study is a heat sensor. This application has one feature to manually configure into sensor hardware tools. This facility is needed to check system performance so that everything runs smoothly so that the time needed for firefighters to reach the scene can be faster and more precise. The system also provides a menu to select the location of the fire sensor in the database list. Settings regarding configuration can also be done by selecting manual or automatic configuration. In the "disaster details" menu, the application provides details related to the disaster such as the type of disaster, the location of the disaster, and even the level of the disaster. The data displayed is very useful for users to estimate or just knowledge if at any time a similar disaster occurs that can be experienced by users anywhere and anytime.
On the “Track” page, the operator will find the position of the reporter using the GPS device that has been installed in the application. This page is very important to determine the coordinates of the complainant as well as to find the closest way to a fire or other disaster.

This disaster mitigation application provides a facility to see the travel route that will be passed by firefighters in the closest route between the fire department to the fire scene. The algorithm in this disaster mitigation system makes it possible to send data to the nearest traffic light so that the green light will adjust to be passed by the fire department. This system, in addition to speeding up the fire extinguisher to the scene of a fire, is also designed to report incidents that are catastrophic in nature. The journey of a fire engine has different characteristics and levels of density. The characteristic in question is when the path in the direction of the fire engine gets a turn of the red traffic light, can the fire engine exit the queue using the contra flow path or the fire engine cannot take the lane because there is a roadblock at that location. Based on testing the accuracy and speed of data transmission, it is found that

Figure 8. Form Page Display

On the “form” page, there are several fields that must be filled in, namely location, current situation and conditions, general situation, special conditions and recommendations. These data are used by operators to make reports that occur to superiors which will then be used to determine what actions will be taken by the disaster management agency on the basis of reports that occur.

On the “Track” page, the operator will find the position of the reporter using the GPS device that has been installed in the application. This page is very important to determine the coordinates of the complainant as well as to find the closest way to a fire or other disaster.
the threshold distance of the map display in this disaster mitigation application will always update the location of different fire engines and are made to use the icon. The distance between the fire engine and the nearest traffic light will be shown on the icon when the application is used in an emergency as shown in Figure 9.

![Map Display](image)

Figure 9. Firefighter's journey to the scene of the fire

3. Testing

Testing consists of 2 kinds, namely:

3.1. Performance efficiency test

This test uses an android application in the form of test android. This application will display the memory usage that will be used by the device. If a memory leak occurs, the application will display information related to what is needed.

3.2. Compatibility

This test is carried out by direct observation at the stage of installing or installing and in running the application on an Android screen on a different screen size.

The results of these two tests are presented in table 1 below.

| No | CPU          | Memory | Information                      | Compatibility |
|----|--------------|--------|----------------------------------|---------------|
| 1  | Samsung J7 Pro | 110    | Usage does not cause memory leak | Success       |
| 2  | LG Nexus 6   | 153    | Usage does not cause memory leak | Success       |
From the two tests, it can be concluded that the test can be concluded that it is feasible to be used as a disaster application to monitor and even cope based on data related to disaster management related to the accuracy and speed of data communication.

Based on the results of research and discussion, this research can be concluded as follows: This research produces an application that can assist firefighters in carrying out their daily duties to be more effective and efficient by using the latest technological developments and also to reduce the number of victims who fall due to fire disasters. The application is built using the Rational Unified Process (RUP) development method, where the risks and errors found will be corrected in several iterations so as to produce a good architecture and high-quality applications. RUP consists of several stages, namely Inception, Elaboration, Construction, and Transition. At each stage in the RUP, iterations of the business modeling, requirements, analysis & design, implementation, test, deployment, configuration & change management, project management, and environment processes are carried out.

The test results on this application show that it is declared feasible in terms of efficiency, performance and compatibility. All memory data shows above the normal threshold of 100.

4. References

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