COMMUNITY SERVICE IMPLEMENTATION OF NATURAL DISASTER INFORMATION APPLICATION AT THE BANJARNEGARA DISASTER MANAGEMENT AGENCY

PENGABDIAN KEPADA MASYARAKAT IMPLEMENTASI APLIKASI INFORMASI BENCANA ALAM PADA BADAN PENANGGULANGAN BENCANA BANJARNEGARA

Dwika Julian Azhar [1], Dimara Kusuma Hakim [2]
[1,2] Informatics Engineering, Faculty of Engineering and Science
Muhammadiyah University Purwokerto
Jl. Raya Dukuh Waluh, Kembaran 53182 , Indonesia.
[1] dwikajulianazhar@gmail.com , [2] dimarakusumahakim@ump.ac.id

ABSTRACT

The development of information technology has a significant impact on individual and group performance. Technology is widely used as a tool for data processing, work, and exchange of information between parties, especially the public and the government. This technology is also used in the Regional Disaster Management Agency (BPBD) of Banjarnegara Regency, especially in disseminating digital information about natural disasters. This is constrained by a problem, namely limited information sources related to the provision of information on disaster locations that can be accessed by the people of Banjarnegara Regency, which causes delays in the process of exchanging information between related parties and the community. This problem gave rise to an idea to overcome this problem by building an Android-based application to map natural disasters in Banjarnegara Regency using the React Native framework to create mobile applications. The system was developed to facilitate users and related parties disseminating and receiving information on disaster areas. The application development method uses the SDLC (Software Life Development Cycle) method with the waterfall model. The implementation of this research uses a qualitative research approach that is focused on application development. The results of this study are an Android-based natural disaster mapping application in Banjarnegara Regency. This research was successfully carried out based on the results of functional tests using the Black Box Test method and feedback from the research subjects, namely the Banjarnegara community using the Beta Test method.

Keywords: *Community Service, android application, disaster information, mapping*

ABSTRAK

Perkembangan teknologi informasi memberikan dampak yang signifikan terhadap kinerja individu maupun kelompok. Teknologi banyak digunakan sebagai alat untuk pengolahan data, pekerjaan dan pertukaran informasi antar pihak, terutama masyarakat dan pemerintah. Pemanfaatan teknologi ini juga digunakan di Badan Penanggulangan Bencana Daerah (BPBD) Kabupaten Banjarnegara khususnya dalam penyebaran informasi digital tentang bencana alam. Hal tersebut terkendala sebuah masalah yaitu keterbatasan sumber informasi terkait penyediaan informasi lokasi bencana yang dapat diakses oleh masyarakat Kabupaten Banjarnegara sehingga menyebabkan terhambatnya proses pertukaran informasi antara pihak terkait dengan masyarakat. Permasalahan tersebut memunculkan sebuah ide untuk mengatasi permasalahan tersebut yaitu dengan membangun sebuah aplikasi berbasis Android untuk memetakan bencana alam di Kabupaten Banjarnegara menggunakan *framework* React Native untuk membuat aplikasi *mobile*. Sistem dibangun dengan tujuan untuk memudahkan pengguna dan pihak terkait dalam menyebarluaskan informasi dan menerima informasi daerah bencana. Metode pengembangan aplikasi menggunakan metode SDLC (*Software Life Development Cycle*) dengan model *waterfall*. Pelaksanaan penelitian ini menggunakan pendekatan penelitian kualitatif yang difokuskan pada pengembangan aplikasi. Hasil

penelitian ini berupa aplikasi pemetaan bencana alam berbasis Android di Kabupaten Banjarnegara. Penelitian ini berhasil dilaksanakan berdasarkan hasil uji fungsional yang dilakukan dengan menggunakan metode *Black Box Test* dan umpan balik yang diterima dari subjek penelitian yaitu masyarakat Banjarnegara, dengan menggunakan metode *Beta Test*.

Kata Kunci: *Pengabdian Masyarakat, aplikasi android, informasi kebencanaan, pemetaan*

INTRODUCTION

Banjarnegara is an area in the western part of Central Java Province with a total area of 106,971.01 ha. Astronomically, the Banjarnegara area is located between 7°12'-7°31' South Latitude and 109°20'10" to 109°. 45'50" East Longitude. Administratively, Banjarnegara Regency consists of 20 sub-districts and 266 villages (Mulyani, 2016). Banjarnegara regency is a district that has a fairly high risk of natural disasters. Natural factors such as high slope, high rainfall, and geological conditions are factors that influence natural disasters in this region (Susanti et al., 2017). According to data from PBDB Banjarnegara, information was obtained that in the period 1 January 2022 – 18 October 2022, there were 298 disaster events. The continuous disasters that befall Banjarnegara Regency should make our awareness increase.

The role of technology greatly influences the performance of both individuals and groups (Indrayani, 2017), especially at the Regional Disaster Management Agency (BPBD) of Banjarnegara Regency. According to Junaedi, the Head of the Prevention Section, said that the agency experienced problems in terms of disseminating digital information on natural disasters. Limited media and facilities in conveying information on the location of the disaster event hampered the process of exchanging information between related parties and the community (Rohadi et al., 2019; Supriatna & Zulfikar, 2021).

The problem regarding the limitations of disaster-related information media that can be accessed by the people of Banjarnegara Regency gave rise to an idea as a solution to overcome this problem, namely by building an Android-based natural disaster mapping application in Banjarnegara Regency. The system was built to facilitate users and related agencies in disseminating data and obtaining information on disaster areas (Wahyudi & Astuti, 2019). The system built also has a feature for reporting disaster events so that the process of exchanging data becomes easier. In this study, the authors used a JavaScript-based framework, namely React Native, to create mobile applications. The process of presenting data is built using digital map technology so that the information presented is easier for users to understand (Munir, 2017).

1.1 Formula Problem

Based on the background of the problems that have been described, the formulation of the problem that arises is to make a mobile phone (Android) based Banjarnegara Regency natural disaster mapping application using the React Native framework which presents data visually in the form of a disaster map using the Google Maps API.

1.2 Limitations Problem

The limitations of the problem in this study are:
1. The system displays the location of the disaster that only covers the Banjarnegara district.
2. The data managed in this system is disaster recapitulation data in Banjarnegara Regency.

1.3 Purpose Problem

The purpose of this research is to design and build a mobile phone (Android) based Banjarnegara District natural disaster mapping application using the React Native framework which visually presents data in the form of a disaster map using the Google Maps API, so that users can easily find the location of the disaster. In addition to displaying a disaster map, there is also a facility for reporting disaster events.

1.4 Benefits Study

The expected benefit of this research is that this application will make it easier for users to find out the location of natural disasters and the details of the disaster.

LITERATURE REVIEW
2.1 Research Previously

The role of information technology is very influential on the performance of individuals and groups. In the agency the role of information technology aims to obtain a value chain from information technology that is useful in all existing aspects. Oriented to increasing effectiveness, and efficiency (Indrayani, 2017), as well as to determine the effect of communication and the application of information technology on employee performance partially and simultaneously (Apriliani & Wijaya, 2021).

The limitations of the media in conveying information cause a lack of information obtained by the community, through a geographic information system it is hoped that it will make it easier to present disaster information for the community (Supriatna & Zulfikar, 2021, Rohadi et al., 2019). Problems regarding the limitations of information media related to natural disasters led to the idea, name to by creating a geographic information system for mapping natural disasters and can help make it easier to obtain information on spatial data and non-spatial data on an ongoing basis. Quickly about the distribution of natural disaster locations (Wahyudi & Astuti, 2019). The geographical information system for mapping natural disasters is made to display maps of disasters that occur in Indonesian territory both in the form of visualization of regional maps and information on disasters that occur by utilizing online mapping technology, namely Google Maps (Munir, 2017).

2.2 Platform Theory

a.   Geographic Information System

Geographic Information System is a system that consists of several components in the form of Human Resources (HR), software, hardware that and are interrelated, so that they can enter, store, manage, update, repair, integrate, analyze, manipulate, or display data. object in the form of a geographic shape (Alhakim et al., 2019)

b.   System Information

The definition of an information system is as a collection of elements that are interconnected with each other that form a single unit to integrate data, process and store and distribute information (Nugraha, 2012). The system is a network of procedures that are interconnected, gathered together to carry out an activity or complete a certain goal.

In the field of information systems, the system is defined as a group of components that are interconnected, working together to achieve a common goal by receiving input and producing output in an orderly transformation process. If a component does not contribute to the system to achieve goals, then the component is not part of the system (Aunurofiq, 2018).

c.   Google Maps API

API or Application Programming Interface is documentation that consists of interfaces, functions, and structural classes for building software. API can be said to be a liaison between an application and other applications that allow programmers to use system functions. Google also provides a Google Map API service that allows developers to integrate Google Maps into their respective websites by adding their own data points. By using the Google Map API, Google Maps can be displayed on external websites (Susetyo et al., 2018).

d.   Android

Android is an operating system for mobile phones based on Linux. Android provides an open platform for developers to create their own applications for use by a variety of mobile devices. Initially, Google Inc. buys Android Inc., a newcomer that makes software for cell phones (Amin, 2019).

e.   React Native

React Native is an open source framework made by Facebook which was created after Facebook previously made react.js, React.JS itself is a library from Facebook that can be used to build a user interface (UI). So, react native is an open source framework for creating multi-platform applications (android, ios and windows platforms "under development") with the Javascript Language (Muharto, 2019) .

f.   PHP

PHP is a scripting language that integrates with HTML and runs on the server side. This means that all the syntax that we provide will be fully executed on the server while only the results are sent to the browser (Haryono et al., 2016).

g. MySQL

MySQL is one type of database that is widely used to create dynamic web-based applications. MySQL is a type of RDBMS (Relational Database Management System). MySQL supports the PHP programming language. MySQL also has a simple SQL (Structured Query Language) query or language and uses the same escape characters as PHP (Muharto, 2019) .

RESEARCH METHODS
3.1 Types of Research

The research method used in this study is a qualitative approach method. A qualitative approach is a process of inquiry to understand social or human problems based on creating holistic images formed by words, reporting detailed views of informants, and organized in a scientific setting (Samsu, 2017) .

In the first stage of this study the authors collected and analyzed qualitative data in answering the formulation of the problem, namely the need for a mobile-based natural disaster mapping application (Android) that presents information visually in the form of a disaster map using Google Maps.

3.2 Methods Development System

In carrying out this research the method used is the System Development Life Cycle (SDLC) method with the waterfall approach. The stages of the SDLC development method with the Waterfall approach are shown in Figure 1. Figure 1 depicts a linear sequence model for software engineering.
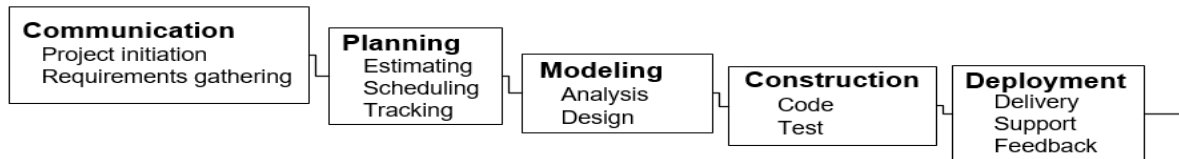

Figure 3. 1. Waterfall Model (Pressman & Maxim, 2015)

a) Communications

This stage is the project initiation stage, how to analyze the identified problems and collect the necessary data, and determine the characteristics and functions of the application.

b) Planning

The Planning stage is the stage for planning or analysis that focuses on estimates of technical tasks to be carried out, risks that can occur, resource requirements such as hardware & applications in creating systems, work products to be obtained & tracking the process of working on the system.

c) Modeling

This phase is the system architecture design and modeling phase, which focuses on the design of data structures, software architectures, user interface displays, and programming algorithms. The modeling phase is also the phase with the system design process in the form of a user interface (UI). At the system planning stage, based on the results of the analysis process carried out in the previous stage, the system is generally created and implemented.

d) Construction

This construction stage is the process of translating the design form into machine-readable code or form/language. Once coding is complete, the system and code are tested. The goal is to find possible errors that can be corrected later.

The coding stage uses a JavaScript-based framework, namely React Native. The testing or testing phase takes place in accordance with the black box testing method. This test is carried out based on system functionality or features.

e) Deployments

This final step is software implementation, software improvement, software evaluation, and software development based on the feedback received so that the system can continue to function and develop according to its function. In other words, it is part of the test (testing).

RESULTS AND DISCUSSION
4.1 Communications
4.1.1 Project Initiation

This phase is the initial phase of the project, where the author makes observations. The problem faced at this stage is the lack of information on the location of the disaster, so people usually do not have accurate information about the location of the disaster.

These problems then produce an idea and a solution that is determined by creating a mobile-based disaster mapping application. The author also implements the disaster event reporting feature by the community.

4.1.2 Gathering requirements

At this stage the author collects several needs that are used as material in the next stage. These requirements include functional requirements, non-functional requirements and data requirements.

4.2 Planning

The planning stage is the stage where the author decides to establish a plan to estimate the time needed to build a geographic information system for disaster mapping. After knowing what the system looks like, the planning stage is also carried out, summarizing user requirements and estimating the time required. This research was conducted according to a predetermined schedule.

4.3 Modelling

This phase is the system architecture design and modeling phase, which focuses on the design of data structures, software architectures, user interface displays, and programming algorithms. The modeling phase is also the phase with the system design process in the form of a user interface (UI). At the system planning stage, based on the results of the analysis process carried out in the previous stage, the system is generally created and implemented. The designs made are in the form of business designs, android user interface designs, website admin interface designs, and database designs.

4.4 .Construction

The Construction stage is the stage of translating the results of the design into a programming language and the stage of testing the functionality. The programming language used is the React Native framework as the interface language and PHP as the server-side language. The type of testing carried out is using the Black Box Testing method. The implementation results at this stage can be seen in the following display:

4.4.1 Coding

4.4.1.1 Display Interface Android users

a) Splash screen Page

The splash screen page is the initial page when the user enters the application. This page displays the application name and logo. The splash screen page display is shown in Figure 2.
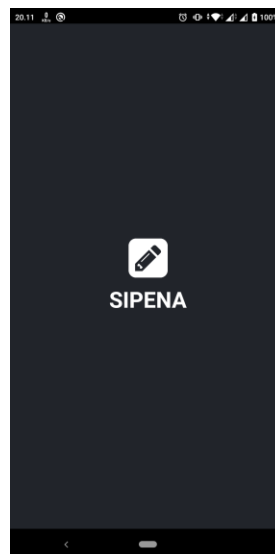

Figure 2. Splashscreen Page

b) On-Boarding Page

The onboarding page is a brief introduction page where there is a button to go to the next page. The display of the on-boarding page is shown in Figure 3.

Figure 3. On-Boarding Page

c)   Home Page

The home page contained in this application consists of 5 main menus, namely reporting, maps, history, about the application and criticism & suggestions. The home page display is shown in Figure 4.
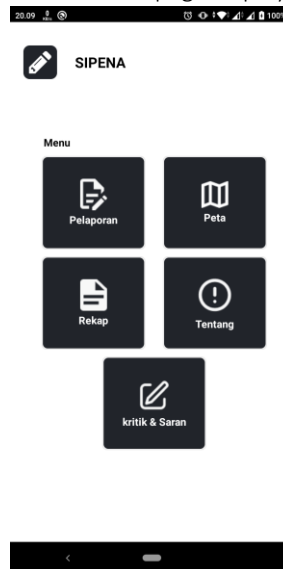

Figure 4. Page Home

d)   Reporting Page

The reporting page serves as a form to fill in the type of incident, scene, damage, loss of life, chronology, file and map for the point where the incident occurred. The display of the reporting page is shown in Figure 5.

Dwika Julian Azhar , Dimara Kusuma Hakim

Implementation of the Android-Based Natural Disaster Mapping Application at the Banjarnegara Regency Regional Disaster Management Agency
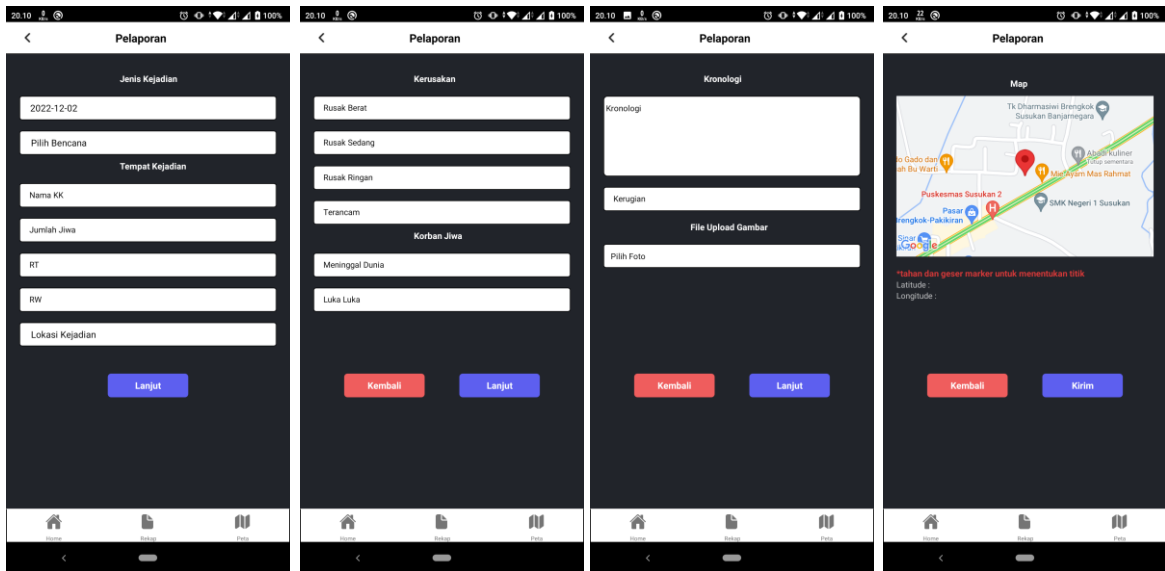
Figure 5. Page Reporting

e)   Map Page

The map page functions as a visual disaster event data that displays disaster markers. Users can choose disaster data to be displayed. The map page display is shown in Figure 6.
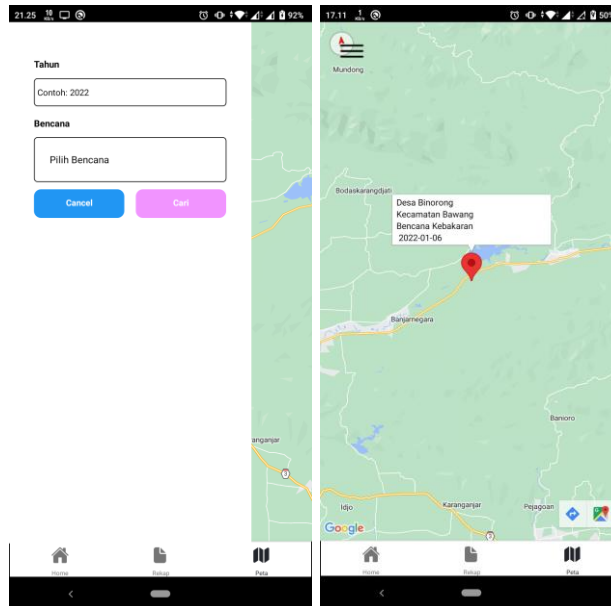

Figure 6. Map Page

f)   History Page

The history page functions to check all reports that have entered the system and have been confirmed by the admin. The history page display is shown in Figure 7.

Dwika Julian Azhar , Dimara Kusuma Hakim

Implementation of the Android-Based Natural Disaster Mapping Application at the Banjarnegara Regency Regional Disaster Management Agency
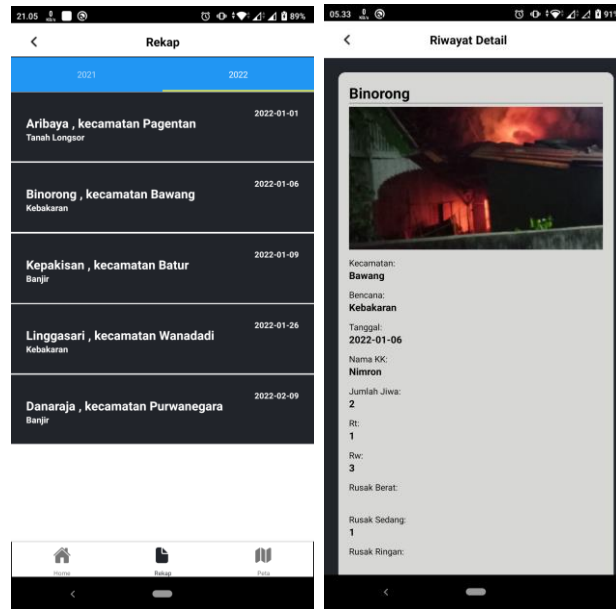

Figure 7. History Page

g)   About Page

This page contains information about related agencies, namely the Regional Disaster Management Agency (BPBD) of Banjarnegara Regency and about the application. The about page display is shown in Figure 8.
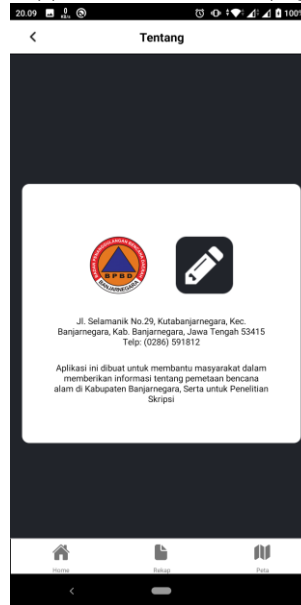

Figure 8. About Page

h)   Criticism & Suggestions Page

The criticism and suggestions page serves to send criticism & suggestions about the application or related parties. The page view is shown in Figure 9.
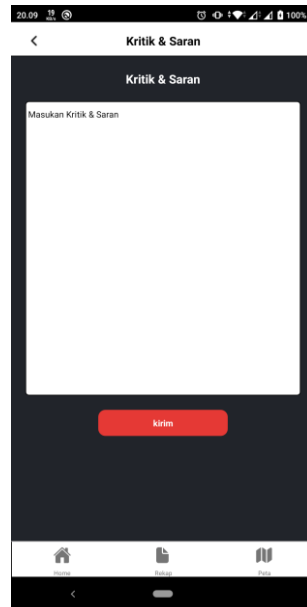
Figure 9. Criticism & Suggestions Page

4.4.1.2 Display Admin Web Interface

a)   Admin Login Page

The Login page is the first page on the admin website. This page requires the admin to enter a username and password in order to enter the admin website. The login page design is shown in Figure 10.
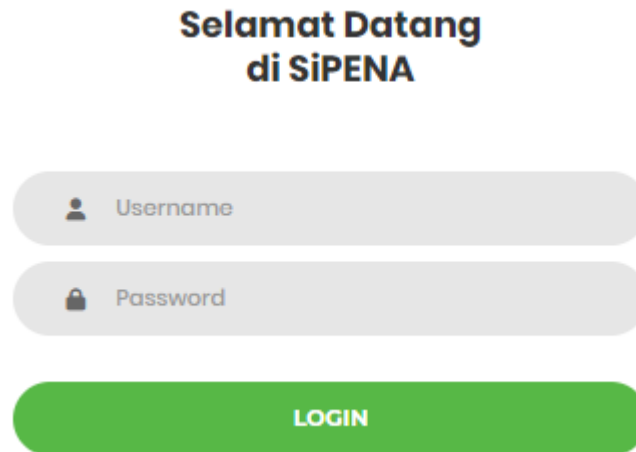

Figure 10. Admin Login Page

b)   Page Dashboards

The dashboard page is the main page on the admin website. This website application displays total reports, sub-districts, villages, and suggestions for criticism. There is also a table data menu, and data recap. The dashboard page design is shown in Figure 11.

Figure 11. Dashboard Page

c) District Data Page

The sub-district data page is a page that contains sub-district data in the Banjarnegara district. There are features to add, edit and delete data. The design of the eyewear data page is shown in Figure 12.

No	Kecamatan	Opsi
1	Banjarmangu	Edit | Hapus
2	Banjarnegara	Edit | Hapus
3	Batur	Edit | Hapus
4	Bawang	Edit | Hapus
5	Kalibening	Edit | Hapus

Figure 12. District Data Page

d) Village Data Page

The village data page is a page that contains village data in the Banjarnegara district. There are features to add, edit and delete data. The village data page design is shown in Figure 13

Dwika Julian Azhar , Dimara Kusuma Hakim

Implementation of the Android-Based Natural Disaster Mapping Application at the Banjarnegara Regency Regional Disaster Management Agency

ID	Desa	Kecamatan	Opsi
1	Jenggawur	Banjarmangu	Hapus
2	Banjarkulon	Banjarmangu	Hapus
3	Banjarmangu	Banjarmangu	Hapus
4	Rejasari	Banjarmangu	Hapus
5	Kesenet	Banjarmangu	Hapus

Figure 13. Village Data Page

e) Detailed Disaster Data Page

The disaster data page is a page that contains natural disaster data in Banjarnegara district. There are features to add, edit and delete data. The design of the disaster data page is shown in Figure 14.

No	Bencana	Opsi
1	Banjir	Edit | Hapus
2	Kebakaran	Edit | Hapus
3	Tanah Longsor	Edit | Hapus
4	Angin Kencang	Edit | Hapus
5	Gempa	Edit | Hapus

Figure 14. Detailed Disaster Data Page

f) Reporting Data Page

The reporting data page is a page that contains reporting data carried out by the user. There is a feature in the status column to confirm data and a delete feature. The reporting page design is shown in Figure 15.

No	Desa	Kecamatan	Bencana	Tanggal	Detail	Status
1	Gripit	Banjarmangu	Banjir	2022-12-20	Detail	Belum diterima
2	Bakal	Batur	Tanah Longsor	2022-02-03	Detail	Belum diterima
3	Kemranggon	Susukan	Angin Kencang	2022-01-28	Detail	Belum diterima
4	Plumbungan	Pagentan	Angin Kencang	2022-03-13	Detail	Belum diterima
5	Klampok	Purworeja Klampok	Angin Kencang	2022-06-16	Detail	Belum diterima

Figure 15. Reporting Data Page

g)   Page Profile

The profile page is the page where the admin can view the admin profile. There is a feature to edit admin data. The profile page design is shown in Figure 16.

Full Name
Dwika Julian azhar

User
Admin1234

Email
zembelldwika@gmail.com

Password
•••••••••

Edit

Figure 16. Profile Page

h)   Reporting Recap Page

The reporting recap page is a page where data that has been confirmed by the admin comes from reporting data. The reporting recap page design is shown in Figure 17.

No	Desa	Kecamatan	Bencana	Tanggal	Detail	Status
1	Binorong	Bawang	Kebakaran	2022-01-06	Detail	Diterima
2	Wanayasa	Wanayasa	Kebakaran	2022-01-14	Detail	Diterima
3	Linggasari	Wanadadi	Kebakaran	2022-01-26	Detail	Diterima
4	Aribaya	Pagentan	Tanah Longsor	2022-01-01	Detail	Diterima
5	Kalibening	Kalibening	Tanah Longsor	2022-01-10	Detail	Diterima

Figure 17. Recap Reporting Page

i)   Criticism & Suggestion Page

The criticism and suggestions page is a page from which the admin can see criticisms & suggestions made by users. The design of the criticism & suggestions page is shown in Figure 18.

No	Kritik & Saran
1	Aplikasi ini dapat dikembangkan kembali dan informasi bencana alam yang didapatkan bisa untuk lebih lengkap

Figure 18. Criticism & Suggestions Page

4.5 Deployments

4.5.1 Feedback

4.5.1.1 Beta Testing

Beta testing aims to find out how good the quality of the resulting application is, whether it is in line with expectations. The beta testing scenario was carried out by distributing questionnaires to 50 respondents.

1) Beta Testing Formula

To get the interpretation results, the respondent's maximum points must be known by formula (1):

$$Q = T \times S$$

note:

Q = Maximum Points
T = Number of Respondents
S = Highest Answer Point

The following is a list of points for each answer shown in Table 1.

Table 1. Table Answer and Points

Answer	Points
Strongly agree	5
Agree	4
Simply Agree	3
Disagree	2
Don't agree	1

After determining the number of points, then calculate the percentage value using formula (2):

$$R = \left(\frac{P}{Q}\right) x\ 100\%$$

note:

P = Respondent Points

Q = Maximum Points

R = Percentage Value

The following is a list of the percentage values of the answers shown in Table 2.

Table 2. Value Respondents

Answer	Percentage Value
Strongly agree	81% - 100%
Agree	61% - 80%
Simply Agree	41% - 60%
Disagree	21% - 40%
Don't agree	0% - 20%

2) Beta Testing Results

The list of questions asked to respondents is shown in Table 3.

Table 3. List Question Beta Testing

No	Question
1	Is the"Application Android-Based Banjarnegara District Natural Disaster Mapping" easy to use?
2	Does the "Android-Based Banjarnegara District Natural Disaster Mapping Application" look interesting?
3	Is the "Android-Based Banjarnegara District Natural Disaster Mapping Application" easy to understand?
4	Has the "Android-Based Banjarnegara District Natural Disaster Mapping Application" run according to what is displayed?
5	Is the "Android-Based Banjarnegara District Natural Disaster Mapping Application" in its use no bugs or errors?
6	Does the Android-Based "Banjarnegara District Natural Disaster Mapping Application " make it easier for you to obtain information regarding the mapping of natural disaster occurrence areas in the Banjarnegara district?
7	Is the "Android-Based Application of Natural Disaster Mapping in Banjarnegara District" appropriate for publication?

The following are the results of the questionnaire which are calculated and totaled according to their respective answers. The results of the questionnaire can be seen in Table 4.

Table 4. Results Questionnaire

Question	Amount Points	Score Percentage
P1	200	80%
P2	202	80.8%
P3	198	79.2%
P4	204	81.6%
P5	198	79.2%
P6	203	81.6 %
P7	200	80%

3) Conclusion from Beta testing
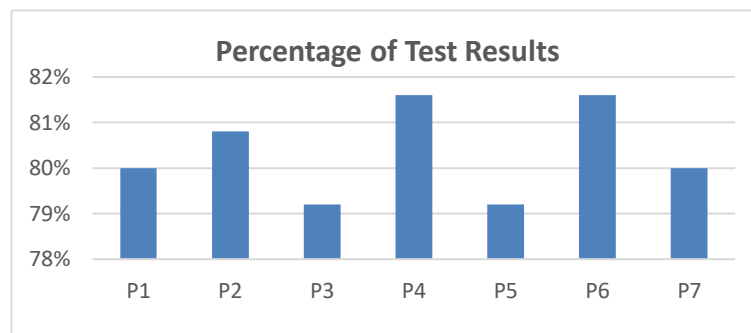
Beta testing shown in Figure 21.

Figure 21. Results Beta Testing

From the results of beta testing, it can be concluded that the application developed fulfills the objectives and benefits of making an Android-based natural disaster mapping application in Banjarnegara District with digital maps and providing information to the public. Facilitating access to information on disaster events in the Banjarnegara Regency area.

4.5.2 Support

This step is carried out after the testing process. The system may change. Changes may be due to errors encountered during testing. If an error is found, the system will be repaired.

CLOSING
5.1 Conclusion

Based on the results and discussion, it can be concluded that the disaster mapping application in the Banjarnegara area has been successfully built and the results of the BlackBox testing state that the system is by the features and functions provided so that it runs as expected. Meanwhile, the results of beta testing or the results of the questionnaire stated that 9.71% strongly agreed (SS), 82.57% agreed (S), 7.14% quite agreed (CS), 0.57% disagreed (KS), 0% disagree (TS) based on these results it can be concluded that the system developed fulfills the objectives and facilitates access to information on disaster events in the Banjarnegara district.

BIBLIOGRAPHY

Alhakim, G., Ramdani, F., & Purnomo, W. (2019). Pengembangan Sistem Informasi Geografis Penanganan Bencana berbasis Website di Kota Malang. *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, *3*(10), 9450–9458.

Amin, A. R. A. (2019). Perancangan Aplikasi E-Report Untuk Korban Bencana Alam di Muaro Jambi Berbasis Android Menggunakan GIS. *2*(4), 282–296. http://repository.unama.ac.id/259/ .

Apriliani, N. K. A., & Wijaya, P. Y. (2021). Peran Komunikasi dan Penerapan Teknologi Informasi Dalam Meningkatkan Kinerja Pegawai Putu Yudy Wijaya *(2) (1)(2)*. *1*(3), 954–961.

Aunurofiq, F. (2018). Aplikasi sistem informasi geografis berbasis mobile view untuk monitoring bencana alam di wilayah kabupaten bogor (studi kasus: bpbd kab. bogor). *Repository.Uinjkt.Ac.Id*, *1111093000036*. http://repository.uinjkt.ac.id/dspace/handle/123456789/48496 .

Haryono, A. T., Rahmawati, D., & Haviluddin. (2016). Aplikasi Program Php & Mysql. In Kriswanto & T. Fitriastuti (Eds.), *Mulawarman Univesity PRESS* (Desember 2). Mulawarman University PRESS. https://doi.org/10.1088/1751-8113/44/8/085201 .

Indrayani, H. (2017). Penerapan Teknologi Informasi Dalam Peningkatan Efektivitas, Efisiensi Dan Produktivitas Perusahaan. *Jurnal El-Riyasah*, *3*(1), 48–56.

Muharto, R. R. (2019). Perancangan Sistem Informasi Profil Sekolah Berbasis Web Pada Sma 3 Kota Ternate. *IJIS-Indonesia Journal on Information System*, *4*(April), 69–76.

Mulyani, W. (2016). Dinamika Kesejahteraan Penduduk di Banjarnegara. *Majalah Geografi Indonesia*, *7*(6), 2016. http://www.ncbi.nlm.nih.gov/pubmed/26849997%0Ahttp://doi.wiley.com/10.1111/jne.12374

Munir, A. Q. (2017). Sistem Informasi Geografi Pemetaan Bencana Alam Menggunakan Google Maps. *Respati*, *9*(26), 1–10. https://doi.org/10.35842/jtir.v9i26.87

Nugraha, D. W. (2012). Perancangan Sistem Informasi Geografis Menggunakan Peta Digital. *Jurnal Ilmiah Foristek*, *2*(1), 117–125.

Pressman, R. S., & Maxim, B. R. (2015). *Software Engineering (Eighth Edi)*. McGrawHill Education.

Rohadi, E., Sa'adah, S. M., & Syaifudin, Y. W. (2019). Pengembangan Sistem Informasi Geografis Lokasi Bencana Di Perkotaan Dan Pencarian Jalur Evakuasi Dengan Algoritma A*. *Jurnal Teknologi Informasi Dan Terapan*, *6*(1), 1–6. https://doi.org/10.25047/jtit.v6i1.106.

Samsu. (2017). Metode Penelitian : Teori dan Aplikasi Penelitian Kualitatif, Kuantittif, dan Mix Method serta Research and Development (M. P. . Dr. Rusmini, S.Ag. (ed.); Issue June). PUSAKA JAMBI.

Supriatna, A. D., & Zulfikar, R. S. (2021). Perancangan Sistem Informasi Geografis Pemetaan Daerah Bencana Longsor di Kabupaten Garut. *Jurnal Algoritma*, *17*(2), 432–439. https://doi.org/10.33364/algoritma/v.17-2.432.

Susanti, P. D., Miardini, A., & Harjadi, B. (2017). Analisi Kerentanan Tanah Longsor Sebagai Dasar Mitigasi Di Kabupaten Banjarnegara. *Jurnal Penelitian Pengelolaan Daerah Aliran Sungai*, *1*(1), 49–59. https://doi.org/10.20886/jppdas.2017.1.1.49-59 .

Susetyo, Y. A., Saian, P. O. N., & Somya, R. (2018). Pembangunan Sistem Informasi Zona Potensi Sumber Daya Kelautan Kabupaten Gunungkidul Berbasis HMVC Menggunakan Google Maps API dan JSON. *Indonesian Journal of Computing and Modeling*, *1*(2), 101–107. https://doi.org/10.24246/j.icm.2018.v1.i2.p101-107 .

Wahyudi, R., & Astuti, T. (2019). Sistem Informasi Geografis (Sig) Pemetaan Bencana Alam Kabupaten Banyumas Berbasis Web. *Jurnal Teknologi Dan Informasi*, *9*(1), 55–65. https://doi.org/10.34010/jati.v9i1.1448 .