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Designing a Fallen Tree Disaster Reporting Application Based on Mobile Android Case Study: Regional Disaster Management Agency (BPBD) Banyumas Regency

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Abstract

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Banyumas Regency is prone to falling trees in the rainy season, but the report on fallen tree disasters is still not focused. The large number of social media used and the regent's complaint booth confuses the reporting process because it is not centralized in one system, making data recording difficult. The authorities in handling the fallen tree disaster are the Regional Disaster Management Agency (BPBD) of Banyumas district. With these problems, an android application was designed that functions to facilitate the process of reporting disasters from the community, as well as the process of recording fallen tree disaster data. The design stage uses the Waterfall method, and the testing uses UAT and black box testing. The testing was carried out by three users, namely the Community, Admin, and Officers. The respondents from the community as many as 120 people, as many as 20 officers, and admin as many as 3 people. The results of the UAT application test are that the application is very helpful for the disaster reporting process; the menu display is attractive; the application can be understood; the type, font size, and color is easy to read; and the users do not find it difficult to make an account, and the application menu meets the users' needs. In the black box testing, it was found that the designed application was very helpful with an average validation percentage of 98% for each menu.

Keywords: Android, Blackbox testing, UAT testing, Waterfall

Abstrak

Kabupaten Banyumas rawan akan terjadinya pohon tumbang pada musim penghujan, pelaporan bencana pohon tumbang masih kurang terarah. Banyaknya media sosial yang digunakan dan lapak aduan bupati membingungkan proses pelaporan karena tidak terpusat pada satu sistem sehingga perekapan data pun sulit dilakukan. Adapun pihak yang berwenang dalam penanganan bencana pohon tumbang adalah Badan Penanggulangan Bencana Daerah (BPBD) kabupaten Banyumas. Dengan adanya permasalahan tersebut dirancanglah aplikasi android yang berfungsi untuk mempermudah proses pelaporan bencana dari masyarakat, serta proses perekapan data bencana pohon tumbang. Tahap perancangannya menggunakan metode Waterfall, pengujian menggunakan UAT dan blackbox testing. Pengujian dilakukan oleh 3 user sebagai pengguna yaitu Masyarakat, Admin dan Petugas. Responden dari masyarakat sebanyak 120 orang, petugas sebanyak 20 orang dan admin sebanyak 3 orang. Hasil pengujian UAT aplikasi sangat membantu proses pelaporan bencana, tampilan menu menarik, aplikasi dapat dipahami, jenis ukuran dan warna font sesuai mudah dibaca, pembuatan akun tidak menyulitkan pengguna dan menu aplikasi sesuai dengan kebutuhan pengguna. Pada pengujian black box testing didapatkan aplikasi yang dirancang sangat membantu dengan rata-rata persentase validasi setiap menu sebesar 98%.

Kata-kata kunci: Android, Blackbox testing, Pengujian UAT, Waterfall



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1. Introduction

Based on the data from the National Disaster Management Agency (BNPB) on natural disasters in 2016 to 2021, Banyumas is a district in Central Java province with the 2nd highest risk of disaster in Central Java, which can be seen in [Table 1](#).

Table 1. BNPB Natural Disaster Data for 2016-2021 [1]

No	County/City	Potential of Exposed Population (Soul)				Class
		Total Population Exposed	Vulnerable Group			
			Vulnerable Age Group	Poor Resident	Disabled Resident	
1	Cilacap	1.653.202	269.976	482.104	7.592	High
2	Banyumas	1.452.358	246.139	378.934	6.512	High
3	Purbalingga	744.472	127.142	271.970	4.510	High
4	Banjarnegara	421.997	68.961	112.996	2.345	High
5	Kebumen	766.596	137.797	272.544	4.205	High
6	Purworejo	567.343	106.757	124.772	4.466	High
7	Wonosobo	238.373	39.094	74.413	919	High
8	Magelang	865.528	142.787	216.503	5.277	High
9	Boyolali	773.788	139.362	162.459	4.143	High
10	Klaten	1.120.124	202.971	353.047	5.239	High
11	Sukoharjo	862.481	135.174	185.650	3.415	High
12	Wonogiri	915.868	180.570	213.668	6.668	High
13	Karanganyar	846.139	139.022	176.323	4.008	High
14	Sragen	860.192	150.011	232.168	4.750	High
15	Grobogan	1.122.204	178.334	310.825	4.564	High
16	Blora	752.429	123.497	191.871	2.818	High
17	Rembang	582.475	84.652	213.173	2.851	High

From the data, it can be concluded that Banyumas regency is an area prone to disasters. One of the disasters in Banyumas regency that occurs a lot in the rainy season is the disaster of fallen trees. This disaster is hazardous because it can damage property, objects and even cost lives. The proneness of falling tree disasters in the rainy season is caused by several factors such as high wind pressure, the movement of land in landslide-prone areas, and the trees that are old and weathered but have not been logged. Data from the Regional Disaster Management Agency (BPBD) Banyumas regency indicate that fallen tree disasters increase over year.

The data of fallen trees can be seen in [Table 2](#).

Table 2. Data of Fallen Trees of Banyumas Regency (BPPD Kab. Banyumas)

Year	2016	2017	2018	2019	2020	2021
Number (Case)	20	30	32	26	40	27

Based on the data above, the number of disasters of fallen trees increases over year. This often occurs due to a lack of monitoring from the relevant agencies and the process of submitting reports of fallen tree disasters that are still not directed. The number of media used to accommodate reporting of fallen tree cases, such as telephones (BPBD call centers), social media (Whatsapp, Facebook, Instagram, Twitter, official websites), and regent complaints have caused the process of submitting reports not to be centralized [2]. In handling the disaster of fallen trees, the BPBD found it hard to locate the disaster accurately, so it takes a long time. In addition, the process of solving disaster data is difficult because the reporting data is spread not in one media. The absence of special media that only handle reports of fallen tree disasters confuses the public in delivering them quickly and accurately.

One of the technological developments that can be applied to this problem is by designing a fallen tree reporting application based on mobile android by utilizing QR codes. The utilization of QR Codes aims to speed up the process of conveying information. QR codes or Quick Respond Codes are an evolution of two-dimensional barcodes [3]. QR codes can be accessed through mobile phones that have a QR code reader application by accessing the internet. The use of QR Codes in fallen tree reporting applications is useful to speed up the process of sending information, which in this case is information about the tree to be uprooted, including the name of the tree, the age of the tree, the size of the tree, and the location of the tree. By simply scanning the QR code attached to the tree, the data of the fallen tree will enter the application and be sent to the BPBD, which will be received via mobile android to be handled immediately by the officers. The process of solving disaster data can also be done through mobile android [4] [5] [6].

2. Method

The research stages at BPBD Banyumas Regency are depicted in the research waterfall method presented in **Figure 1** [7].

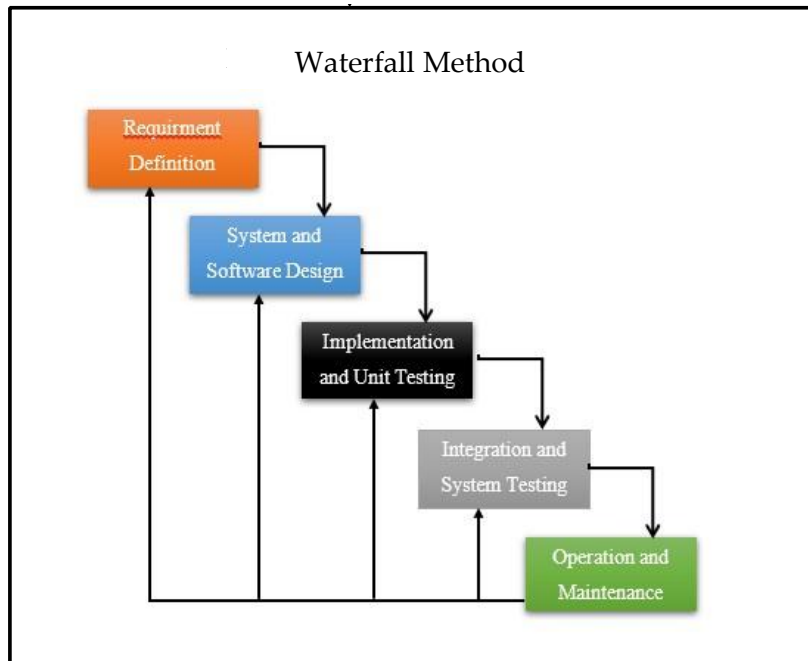


Figure 1. Waterfall Method

The stages of the Waterfall method are as follows [8].

a. Requirement Definition

At this stage, a needs analysis was carried out on how the android-based fallen tree disaster reporting application would be applied in the community and in BPBD. Needs analysis includes hardware, software, and data (data on fallen tree disasters from BPBD in 2016-2021). Data collection is intended to obtain the right data so it answers the formulation of research problems. The collection of data was carried out in the following ways:

1) Observation

At this stage, direct observations were carried out on the environment about the problem of falling tree disasters where currently the process of reporting fallen trees in Banyumas regency.

2) Interview

At this stage, an interview was conducted to the Regional Disaster Management Agency (BPBD) of Banyumas regency. The interview data taken were that of cases of fallen tree disasters that occurred in Banyumas regency from 2016 to 2021. From the data of the case of the

fallen tree disaster, an expansion was carried out to find out the increase or decrease in the disaster of fallen trees in Banyumas regency.

3) Documentation

Data on the 2010-2021 tree disaster were obtained from BPBD Banyumas regency.

b. System and Software Design

At this stage, the design of the system was carried out. System design was built using UML (Unified Modeling Language), which supports object-based programming. The system design would then be adjusted to the users' needs, in this case, the BPBD of Banyumas regency. The use of UML facilitates the creation of a system and is structured.

c. Implementation and Unit Testing

At this stage, the application was made in the form of android on the admin, community, and officer sides. The application can later run on at least the android version of kitkat. The programming language used is the java programming language and android studio software as a tool.

d. Integration and System Testing

At this stage, system testing was carried out to figure out which system met the plan and function properly. This testing was done with User Acceptance Test (UAT) and Blackbox Testing.

e. Operation and Maintenance

At this stage, the system that has been completed in the trial can be used by the user. The users of this system are the community, admins, and BPBD officers. All systems are in the form of android, and the community as a system user can report the disaster of fallen trees. The admin will run a system that serves to receive reports of the fallen tree cases from the community, and will forward them to the officer and conduct data on the cases. For officers, it can be used to receive reports, report hoaxes, and verify report data directly to the location. If there are changes to the needs of the system, repairs or maintenance will be carried out.

3. Results and Discussion

a. Use Case System Diagram

Use case diagrams are used to describe functions and activities in the system that can be seen by the actor (user). In this study, the actors were classified into three, namely: Community,

Officer, and Admin [9]. The use case for the disaster reporting application of fallen trees is presented in Figure 2.

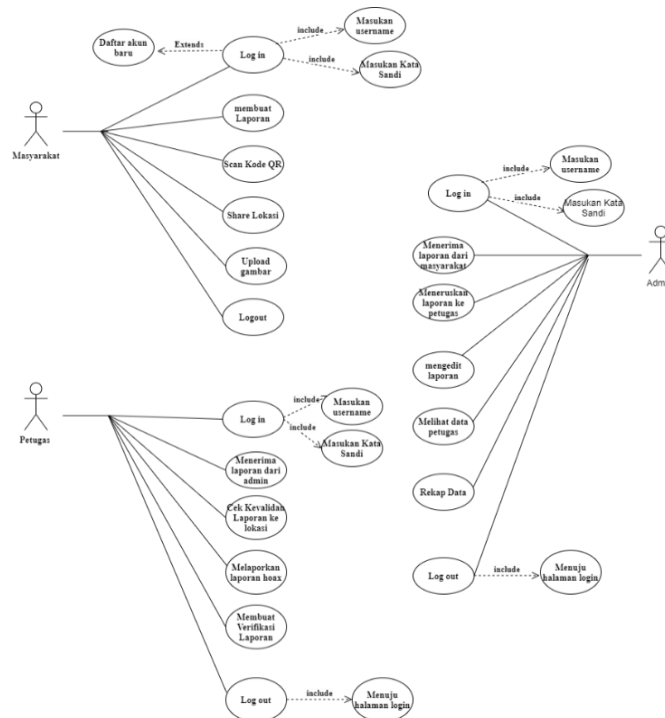


Figure 2. Use case of fallen tree disaster reporting application

b. System Interface

Users in this study consisted of three, namely the community, officers, and admins. The interface view of each user is different and will be adjusted to its functions and needs [10]. The system view that has been created is as follows:

1) Community User Interface Page

The login and account registration views on the fallen tree reporting app for community complaints is presented in Figure 3.

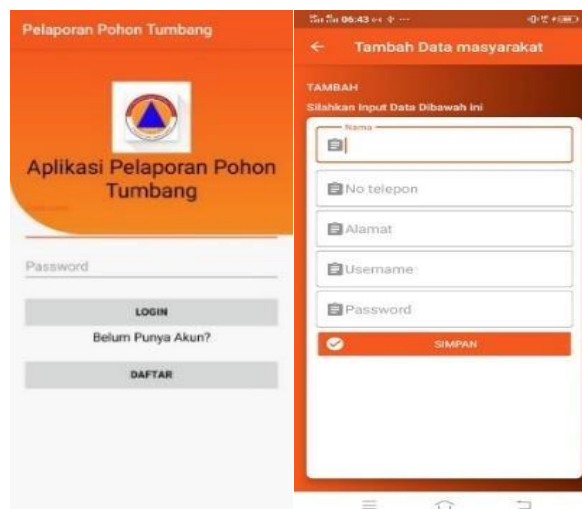


Figure 3. Login and account registration views for the public

The menu display of the fallen tree disaster reporting application on the community side consists of 4 menus, namely the Application Instruction for Use, Disaster Report, Notification, and Sent Report. The display is presented in [Figure 4](#).

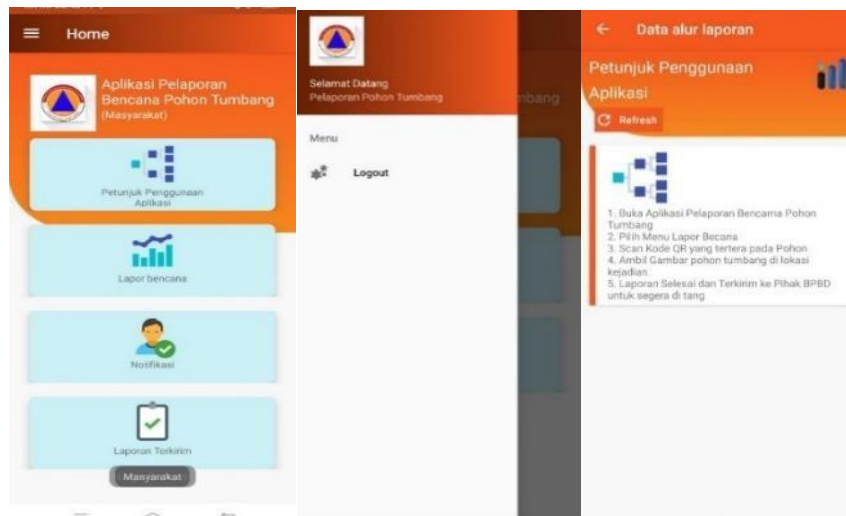


Figure 4. Display of All Menus for Community Complaints

The appearance of the disaster report menu, on this menu the community can do disaster reporting of fallen trees by scanning a QR code, uploading an image, filling in the chronology on the form, and then clicking the reporting process. After that, the report created will be sent directly to the admin. The notification menu will be visible after the community reports the disaster of fallen trees. In the notification menu, you will see the QR code, date, hour, chronology, and handling status. The amount of damage, note, and the parties involved will be filled in after the officer verifies the disaster. In the notification menu, there is also a status of the report process. This view is presented in [Figure 5](#).

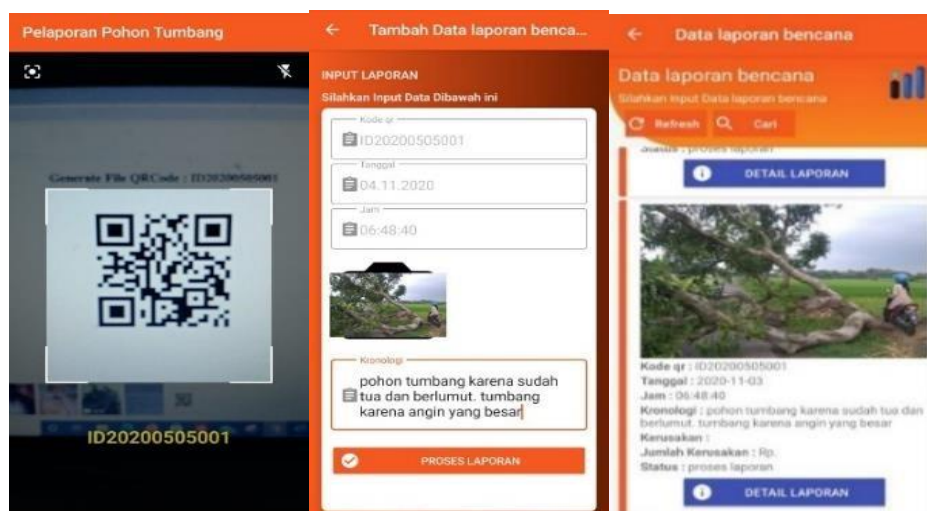


Figure 5. View of disaster report menus and notifications

The menu display of the sent report contains a list of disaster reporting history that has been completed. This view is presented in **Figure 6**.

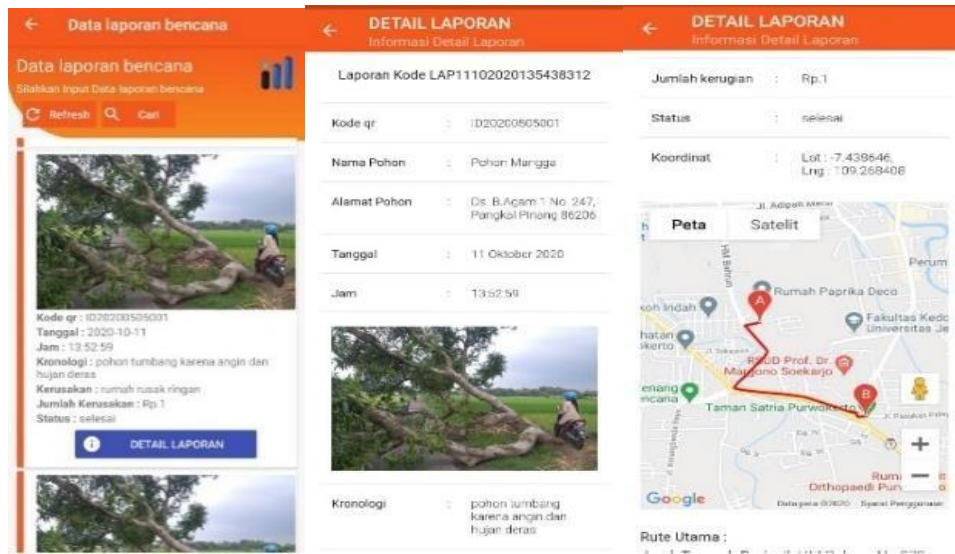


Figure 6. Sent Report Menu View and Location Map of Fallen Trees

2) Officer User Interface Page

The officer's login view, username, and password were created by the admin, so the officer cannot register their own account. The menu display on the officer's side consists of three menus, namely Notifications, Disaster Verification, and Handling History. The display is presented in **Figure 7**.

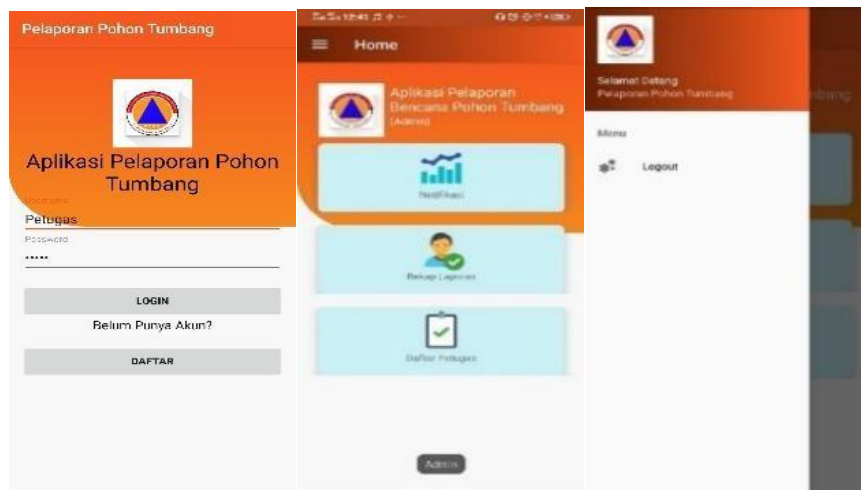


Figure 7. Officer Login View and Officer Menu View

Officer notification is visible after the admin submits the community report to the officer. There are two actions that can be taken by officers for disaster management, namely the details of the report to see the entirety of the fallen tree info, and action to deal with disasters to approve handling efforts. To approve disaster management, officers click deal with the disaster and click update on the action form. The view of the handling history menu contains a history

of handling the disaster of fallen trees carried out by officers. So, it presents how many reports of fallen tree disasters have been handled, it also shows the location of the officers and the location of the disaster event. The display is presented in **Figure 8**.

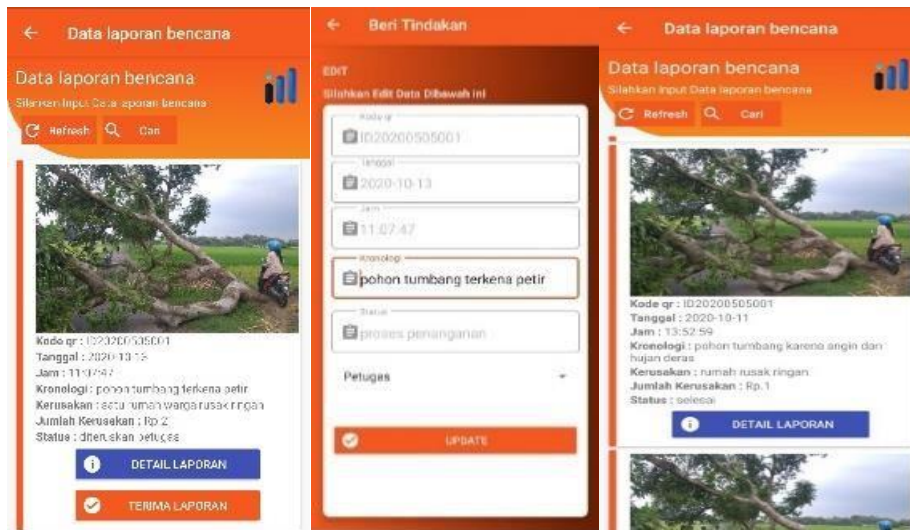


Figure 8. Officer Notification Menu View and Handling History Menu

The view of the disaster verification menu is a display that must be filled in by officers after handling the disaster at the scene. The officer must then fill in the chronology, damage and amount of loss, and then click the update to complete the handling process. The verification data from the officer will enter the system. There is a hoax report menu to report invalid reports after checking the disaster site. The display is presented in **Figure 9**.



Figure 9. Disaster Verification Menu View

3) Admin User Interface page

Login view and admin menu consists of three menus, namely Notifications, Report Recap, and Officer List. The display is presented in **Figure 10**.

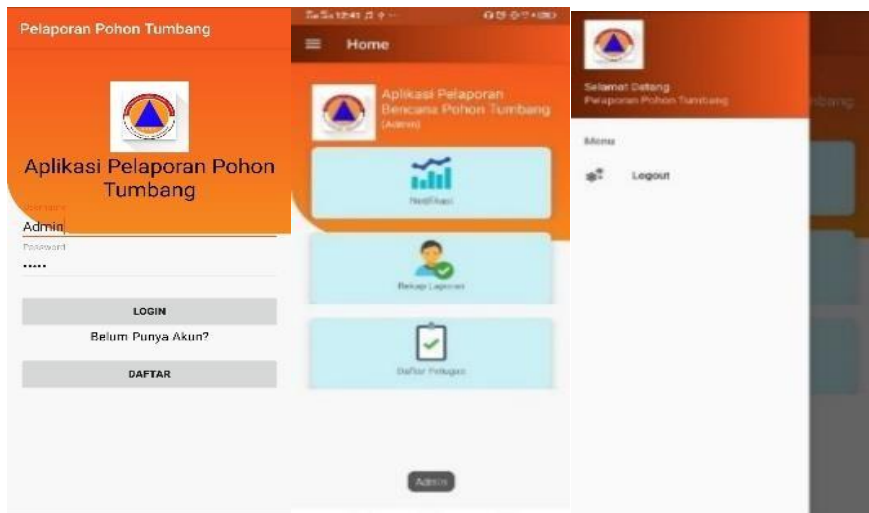


Figure 10. Admin Login View and Admin Menu

Admin notification display contains reports of fallen tree disasters sent by the community. Admins can only see notifications and cannot perform actions. The officer's menu display contains the data of officers who have been registered in the system that will carry out the disaster management process to the scene. In this menu, admins can edit or delete. The display is presented in **Figure 11**.

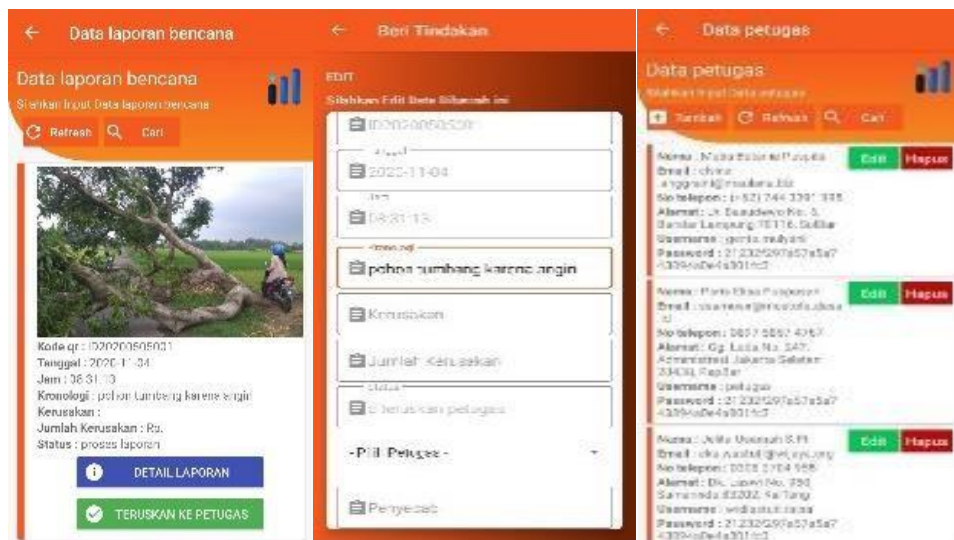


Figure 11. Admin Notification View and Officer List on the Admin Page

The next is the recap view of the report. On this menu, admins can see data on fallen tree disasters that occur starting from the type of fallen tree, date, hour, photo of events, damage, the number of losses, handling status, and the names of fallen tree disaster officers and whistleblowers. Data on fallen tree disasters can be done and printed according to the needs of the admin. Data expansion can be done by filling in the date of the disaster of the fallen tree needed.

A recap view of the report is presented in **Figure 12**.

Figure 12. Recap View of Reports of Fallen Trees Disaster

c. Discussion

1) System testing using Blackbox Testing

In community blackbox testing, the study used questionnaires for data retrieval using google form. This questionnaire was filled out by 120 residents from Banyumas. Uto test the application in the officer using a printed questionnaire filled out by 20 officers from BPBD. U wants to test the system on the admin side using a printed questionnaire filled out by 3 BPBD people. System test results with black box testing are presented in the following **Table 3**.

Table 3. Testing Applications from One Community Users

No.	User	Test activity	Expected results	Conclusion
1	Community	Click the application instructions menu	View the App instructions page	Valid
2		Click the disaster report menu	View disaster report pages	Valid
3		Click the QR code scan menu on the disaster report menu	Processing scanned QR codes	Valid
4		Click the image upload menu on the QR code scan menu	Displays an image of the tree to be uploaded	Valid
5		Click the report process button after uploading the image	Report sent to system	Valid
6		Click the notification menu	Displays the status of notifications that have been sent to the system	Valid
7		Click the sent report menu	Display the history of disaster reports that have been submitted	Valid

Application testing from one user officer is presented in [Table 4](#).

Table 4. Application testing from one user officers

No.	User	Test activity	Expected results	Conclusion
1	Officer	Click the notification menu	View notification pages	Valid
2		Click the details button in the notification menu	View report details	Valid
3		Click the receive report button in the notification menu	View action forms and report updates	Valid
4		Click the disaster verification menu	View the disaster verification menu page	Valid
5		Click the report details button in the disaster verification menu	View report details	Valid
6		Click the hoax report button in the disaster verification menu	View delete report actions	Valid
7		Click the verification button in the disaster verification menu	View action forms and report updates	Valid
8		Click the handling history menu	View all reports you've handled	Valid
9		Click the details button in the handling history menu	View report details	Valid

Application testing from one user admins is [resented on [Table 5](#).

Table 5. Application Testing from One User Admins

No.	User	Test activity	Expected results	Conclusion
1	Admin	Click the notification menu	View notification pages	Valid
2		Click the details button in the notification menu	View report details	Valid
3		Click the forward button to task	View a form handling and updating reports	Valid
4		Click the report recap menu	Displays all incoming reports.	Valid
5		Click the preview button	View report data selected	Valid
6		Click the download button	Download a report data file in pdf form	Valid
7		Click the officer list menu	View menu pages	Valid
8		Click the edit button and delete it on the officer list menu	View edit actions and delete officer lists	Valid

After the trial was carried out by one of the user representatives from the community,

from officers, and admins, then testing was carried out on all respondents involved, from the community, officers, and admins. The testing was carried out on only the most important pages and features in the application. Data on the conclusion of the successful use of software features are presented in the [Table 6](#).

Table 6. Conclusion of 120 respondents from the Society

No.	User	Testing activities	Expected results	Conclusion
1	Community	Login Process	Successful Login	80 %
2		Account Registration	Account Registration Successful	77,5%
3		Show the application instructions for use menu	Show the application instructions for use menu	80 %
4		click disaster report menu	click the disaster report menu successfully	79,2 %
5		Scan QR code	Scan QR code Succeed	78,3 %
6		Upload an image	Image Upload Successfully	78,3 %
7		Display the Sent menu	Displaying the Sent Successful menu	79,2%

Conclusion of 20 respondents from the officer is presented in [Table 7](#).

Table 7. Conclusion of 20 Respondents from the Officer

No.	User	Testing activities	Expected results	Conclusion
1	Officer	Login Process	Successful Login Process	100%
2		Account Registration	Account Registration Successful	100%
3		Testing menus on officers such as notification menus	Testing menus on officers such as notification menu Success	100%
4		Menu disaster verification	Disaster verification menu Succeeded	100%
5		Handling the history menu	Handling history menu Successfully	100%

Conclusion of 3 respondents from admin is presented in [Table 8](#).

Table 8. Conclusion of 3 Respondents from Admin

No.	User	Testing activities	Expected results	Conclusion
1	Admin	Login Process	Successful Login Process	100%
2		Account registration	Account Registration Successful	100%
3		Notification menu	Successful notification menu	100%
4		Report recap	Recap of the Successful report	100%
5		Menu officer list	Menu officer list Succeeded	100%

2) UAT Testing

Furthermore, User Acceptance Testing (UAT) is a verification process that the solution made in the disaster reporting system of fallen trees is appropriate for users by using question surveys on google forms addressed to the Community, Officers, and Admins. It was concluded that the application is very helpful for the disaster reporting process; the menu display is attractive; the application can be understood; the type, font size, and color is easy to read; and the users do not find it difficult to make an account, and the application menu meets the users' needs.

4. Conclusion

The results of the system testing with black-box testing in the community with 120 respondents obtained from the results of Table 6 an average of 78.93% were successful, some failures were due to the system still having bugs so that it was delayed and people were still not familiar with the system. Testing the officers with 20 respondents obtained from Table 7 an average of 100% successful. Testing on the admin with three respondents, the results from table 8 are an average of 100% successful. UAT testing conducted on the Community, Officers, and Admins concluded that the application helps the disaster reporting process.

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