Development of Recommendation Application for Evacuation Due to Flood Disaster from River Field Officers for Communities in Cimanuk-Cisanggarung River Flow Area

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ABSTRACK

BBWS Cimanuk-Cisanggarung is a technical implementation unit at the Directorate General of Water Resources, Ministry of Pekerjaan Umum and Perumahan Rakyat which has the task of carrying out water resources management in the river area. As for the background of this study is the difficulty of river field officers to notify the announcement to the people who will be affected by the flood due to overflowing rivers, because the announcement is still a simple medium that is using sirens and hoaxes or electric poles. Geotagging technology and Fire Cloud Messaging Technology (FCM) is one of the ways to help field officers make public announcements through smartphone media, namely notifications that include river photos and locations. The difficulty of the people who are close to the Cimanuk-Cisanggarung watershed to get information about evacuation places before the flood occurs, because many people choose a place of refuge with their own choice. This is what makes the government more extra to provide assistance to unknown refugee camps. Google Maps technology can help people get to refugee camps recommended by the government. This research method consists of identifying problems, methods of data collection, system analysis, system design, system implementation, testing, and drawing conclusions. The results of the study show that river field staff and the community can be used as a notification of the river that will overflow and provide information on the place of refuge.

keywords **:** FCM, Geotagging, Google Maps, notification, refuge.

1. INTRODUCTION

The Central Office of the Cimanuk-Cisanggarung River Region is a technical implementation unit (UPT) at the Directorate General of Water Resources, Ministry of Public Works and Public Housing which has the task of carrying out water resources management in the river area and giving an announcement to the local community regarding river overflows. The announcement can be interpreted as a message delivered to each person who becomes each person who is the goal or the target of the intended information. [1].

Based on the results of the interview with Mr. Dodo Wardoyo, S.T as a technical officer in Operation and Maintenance of Water Resources III and approved by Mr. I Gusti Ngurah Antariza, S.T., M.T. as Acting Maker of SDA III Commitment and Maintenance, in February 2018. The constraints are the difficulty of river field officers to notify the public of those who will be affected by the flood due to overflowing rivers in the Cimanuk-Cisanggarung watershed because the announcement is still a simple medium that is using sirens and hoaxes or electric poles.

Another obstacle is the difficulty of people who are close to the Cimanuk-Cisanggarung watershed to get information about evacuation places before the floods occur because many people choose a place of refuge with their own choice. So the government is working harder to provide assistance to unknown refugee camps.

As for similar research, Fariz et al's [2] regarding the use of Firebase Cloud Messaging technology. Firebase Cloud Messaging is able to run the push notification feature and receive notifications. In Wisnu et al's research [3], regarding the notification of flood disasters by using Geotagging technology features. In Julia et al's research [4], discusses the geographical information system in determining the location of flood disaster evacuation in the form of a virtual map, namely Google Maps..

In Development, this application utilizes Android smartphones because from the data website The Statistic Portal shows in December 2017 that the Android operating system is most widely used in Indonesia with a percentage of 88.37%. [5]

Geotagging technology and Fire Cloud Messaging Technology (FCM) is one of the ways to help field officers make public announcements through smartphone media, namely notifications that include river photos and locations. FCM is a

development from Google cloud messaging. Firebase Cloud Messaging (FCM) which has the ability to send and receive notifications. [2]

Google Maps technology can help people get to refugee camps recommended by the government. Google maps is a virtual world map service available on smartphones and websites. [3]. Besides that, it is Simple Additive Weighting to calculate the best refuge place recommendations.

Thus, the application of recommendations for evacuation places built in this study can facilitate river field officers in giving announcements about the river that will overflow and the community can receive information about the river that will overflow and recommendation for evacuation sites..

2. RESEARCH CONTENT

2.1 Theoretical Basis

Some theoretical foundations become references in research such as the explanation of river theory, floods, displacement, recommendations, Simple Additive Weighting, information technology, Firebase Cloud Messaging, Geotagging, Google Maps.

2.1.1 Watershed

The watershed is a land area which is a unity with the river and its tributaries, which functions to accommodate store, and transport water from rainfall into the sea naturally, the boundary on land is a topographic separator and boundary in the sea until with water areas that are still affected by land activities. [6]

2.1.2 Flood

Flooding is one of the events of overflowing river water. one of the floods that occurred in the Ciledug, Cirebon area that occurred due to the Ciledug River overflow on 24 February 2018 can be seen in Figure 1.



source: http://cdn.metrotvnews.com

Figure 1. Ciledug Flood

Floods that often occur in the Cimanuk-Cisanggarung river basin can be seen in table 1.

Table 1. Flood in Watershed Cimanuk-Cisanggarung

Watershed	Flood	Date	Refuge
Cibuaya		23 /01/ 2014	
Cimanuk		12 /02/ 2018	
Cimanuk		16 /03/ 2018	
Cimanuk		22 /11/ 2017	
Jatiroke		10 /02/ 2018	
Kalibangka		17 /02/ 2018	
Ciberes		02 /02/ 2017	
Cisanggarung		26 /02/ 2018	
Cisanggarung		01 /03/ 2018	
Cisanggarung		23 /02/ 2018	
Cisanggarung		23 /02/ 2018	

2.1.3 Evacuation

Refugees are people who leave their homes to protect themselves from a disaster. Usually, the disasters that occur during the evacuation are disasters in the form of floods, landslides, volcanic eruptions, tsunamis, and fires. Refugees are usually placed which makes it easy for volunteers to help them. The duration of evacuation is based on the condition and situation of the disaster that occurs, if it is safe, the evacuation is allowed to put the house back.

2.1.4 Recommendation

Place recommendations are suggestions for places that are advocating, justifying, or reinforcing the best place. The recommendation of this place is very important and helps the community in convincingly choosing a place. In this recommendation usually have criteria that become the main reference, for example, a comfortable place or place that is often chosen by others. [7]

2.1.5 Simple Additive Weight

The Simple Additive Weighting (SAW) method can also be called the weighted addition method. Basically the SAW method is used to find the weighted sum of performance ratings in each alternative in each of the existing criteria. The alternative is determined to go through the process of normalization of the decision matrix (X) based on the scale derived from the weight of each attribute. [8]

2.1.6 Information Technology

Information Technology is the study, design, development of implementation, support, or management of computer-based information systems, especially software and hardware applications. Furthermore, information technology relates to the use of computers and software to change, store, protect, process, move and use information securely.

Today the term information technology is growing, covering many aspects related to computing and technology. The combination of computer and communication, also called information technology. Therefore, information technology in general management describes technologies that produce, manipulate, store, communicate, and / or disseminate information. The conclusion is the use of computers in relation to handling current information, referred to as information technology. In its development, information technology was then associated with the use of the internet as a medium for sending and receiving information. [9]

2.1.7 Firebase Technology

Firebase is a cloud-based back-end as a service (BaaS) technology from Google that provides various services, one of which is the push notification feature called firebase cloud messaging. Firebase cloud messaging is a development of Google Cloud Messaging (GCM) that provides services so that developers can send notification messages to Android devices from the server. [2]

2.1.8 Geotagging Technology

Geotagging merupakan proses penambahan informasi geospasial pada berbagai media digital. Media yang telah mengalami proses geotagging akan memiliki informasi koordinat berupa longitude, latitude dan altitude. Pada penelitian ini metode Geotagging yang digunakan untuk melakukan penambahan informasi lokasi pada metadata foto adalah Geotagging [3].

2.1.9 Google Maps Technology

Google maps is a virtual world map service provided by Google Inc. Google maps can be attached as elements in the user interface layout designed by programmers. This Google Maps feature can be used embedded in several programming languages including Android through an application bridge called Application Programming Interface (API). [4]

2.2 Research Methods

The stages of the research method used are the data collection stage and the Android application development stage.

2.2.1 Data Collection Phase

Stages of data collection by means of interviews, observation, and literature studies.

1. Interview

The interview was conducted at BBWS having its address at Jl. Jendral Ahmad Yani Kav. 1 by giving some related questions that will use the application when it is built.

2. Observation

Observations were made to support research by going directly to the river in area 3 of Cirebon.

3. Literature Study

This study was conducted by studying and researching various literatures originating from print and electrical media related to the construction of applications for recommendations for evacuation sites for flood disasters in the Cimanuk-Cisanggarung watershed.

5.1 Software Development Phase

The stages of the software development method refer to the Waterfall according to Ian Sommerville [10], which can be seen in Figure 2.

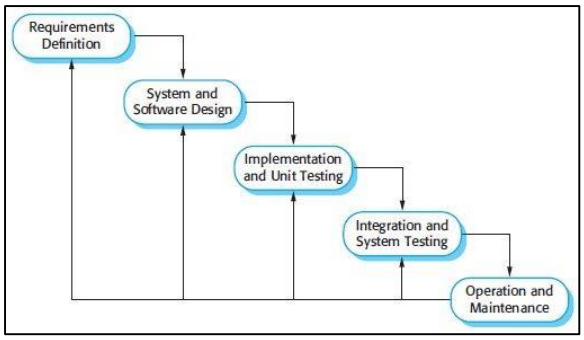


Figure 2. Stages of Application Development for Recommended Refugees

2.3 Results and Discussion

This stage consists of problem analysis, system architecture, analysis of system design and implementation technology, testing and results of research trials.

2.3.1 Analysis of the SAW Method

Criteria that are carried out in evacuation recommendations can be seen in Table 2.

Table 2. Kriteria

Criteria	Information
Place Distance	The closer the better
Distances of river basins	The farther the better
Land	Government buildings are better than school buildings, while school buildings are better than places of worship, and places of worship are better than open fields.
Elevation	The higher the better

In SAW the weighting of each criterion used to do the sum is weighted in the SAW calculation. Weighting results based on agency agreements can be seen in tables 3-6, While the weighting criteria for recommendation for evacuation places in table 7 weighs the criteria for evacuation sites.

Table 3. Weight of Evacuation Distance

No	Place Distance	Weight
1	0 – 499 m	4
2	500 – 999 m	3
3	1000 – 1999 m	2
4	2000 – ∞ m	1

Table 4. Weighting Criteria for DAS Distance

No	Place DAS	Weight
1	2000 – ∞ m	4
2	1000 – 1999 m	3
3	500 – 999 m	2
4	0 – 499 m	1

Table 5. Weighting of Land Criteria

No	Place	Weight
1	Bangunan Pemerintahan	4
2	Sekolah	3
3	Tempat Ibadah	2
4	Lapangan	1

Table 6. Elevation Weighting

No	Interval	Information	Weight
1	16 – ∞ m	Very high	4
2	11 – 15 m	High	3
3	6 – 10 m	Medium	2
4	1 – 5 m	Low	1

Table 7. Criteria Weight

Cij	Criteria	Weight
C1	Place Distances	40%
C2	DAS Distances	30%
C3	Land	20%
C4	Elevation	10%

In the case of the SAW method, the criteria for evacuation can be seen in table 8.

Table 8. Criteria

no	Place Distance	DAS Distance	Land	Elevation
1	0.7	0.81	Government	Low
2	1.51	1.82	Government	Low

Here is an alternative table of criteria that can be seen in table 9.

Table 9. Alternative Criteria

Alternative	Criteria			
	C1	C2	C3	C4
Place 1	3	2	4	1
Place 2	2	3	4	1

Place 1

r11 = 3/(Max(3,2,4,1)) = 3/4 = 0.75
r21 = 2/(Max(3,2,4,1)) = 2/4 = 0.5
r31 = 4/(Max(3,2,4,1)) = 4/4 = 1
r41 = 1/(Max(3,2,4,1)) = 1/4 = 0.25

Place 2

r12 = 2/(Max(2,3,4,1)) = 2/4 = 0.5
r22 = 3/(Max(2,3,4,1)) = 3/4 = 0.75
r32 = 4/(Max(2,3,4,1)) = 4/4 = 1
r42 = 1/(Max(2,3,4,1)) = 1/4 = 0.25

Results from normalized performance rating values.
V1= 0.4(0.5)+ 0.3(0.75)+0.2(1)+0.1(0.25) = 0.675
V2= 0.4(0.75)+0.3(0.5)+ 0.2(1)+0.1(0.25) = 0.65

The biggest assessment results are in place 1, with a value of 0.675 so that place 1 can be used as the first alternative in the selection of refugee camps.

2.3.2 Class Diagram

Class diagram that discusses the structure of defining classes created to build a refugee image drawing system, Figure 3 is a class diagram of a refuge reference application.

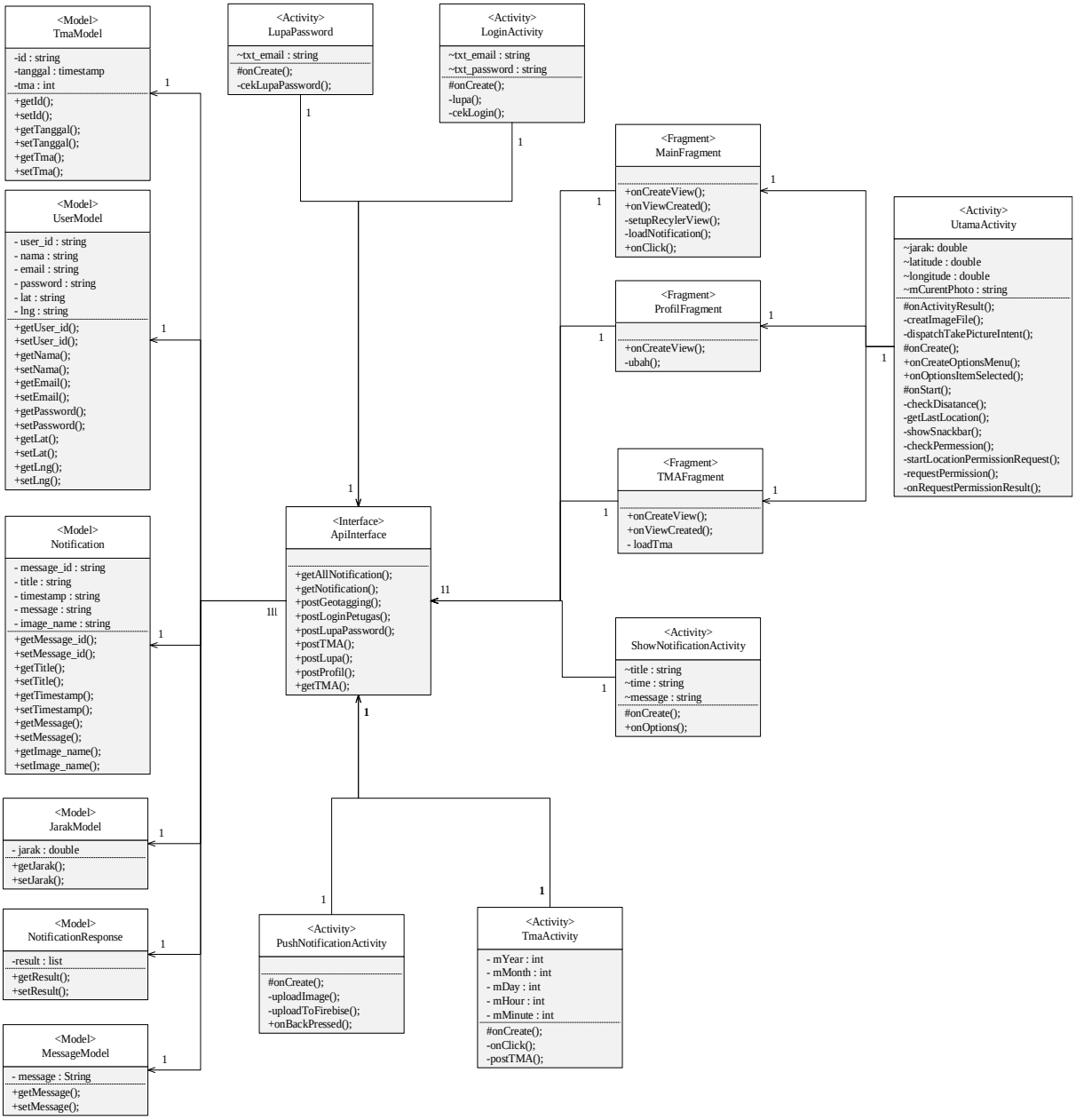


Figure 3. Class Diagram

2.3.3 Interface Design

Designing an Android interface is a design or mockup that is implemented for officers and the community. The following is the design of the Android Interface found in the construction of recommendations for evacuation sites for floods.

1. Login View

The login view provides clarity of the page about the form to enter the access rights to manage the Android application used by the officer. The design of the display of access rights (login) can be seen in Figure 4.

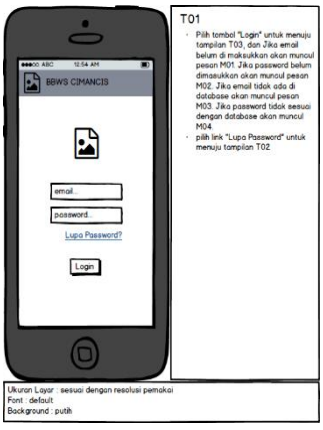


Figure 4. Login View

2. Forget Password View

Forget Password view provide clarity of page about form to forget password used by officer. Designing a forgotten password display interface can be seen in Figure 5.



Figure 5. Forget Password View

3. Home view

Home view officer provide page clarity about the main page or home of the officer. The design of the clerk's Home display interface can be seen in Figure 6.

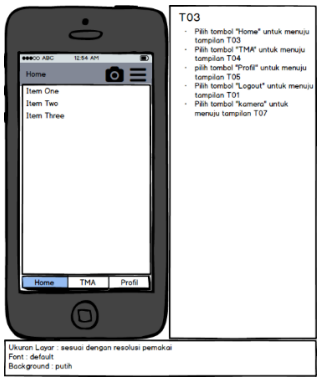
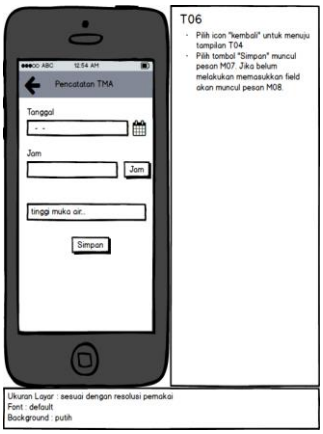


Figure 6. Home View

4. Notes TMA View

Notes TMA view provides clarity on the addition of river TMA records. Designing a water level display record interface can be seen in Figure 7.



Gambar 7. Notes TMA View

5. Send Notification View

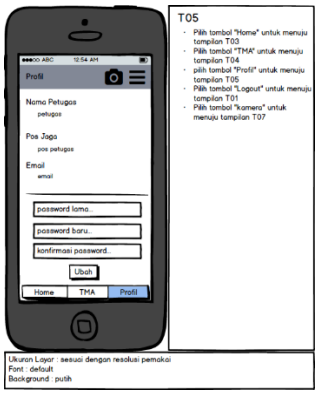
Notify send view gives page clarity to send notification floods. Designing a notification send display interface can be seen in Figure 8.



Figure 8. Send Notif View

6. Edit Profile View

Edit profile view provide clarity of officer profile page to change password. Designing a picture display change profile can be seen in Figure 9.



Gambar 9. Edit Profile View

7. Main View

Main view provide clarity on the main page of the application for the community. Designing the main display interface can be seen in Figure 10.



Figure 10. Main View

8. River Data View

River data view provide clarity of river data pages and can search. The design of the river data display interface can be seen in Figure 11.

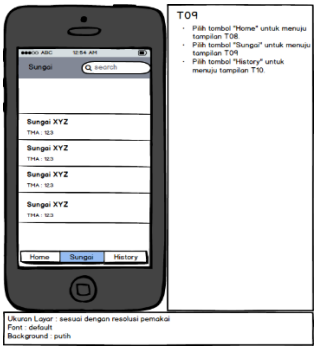


Figura 11. River Data View

9. Flood Data View

Flood data view provide clarity of flood data pages and can search. Designing a flood data display interface can be seen in Figure 12.

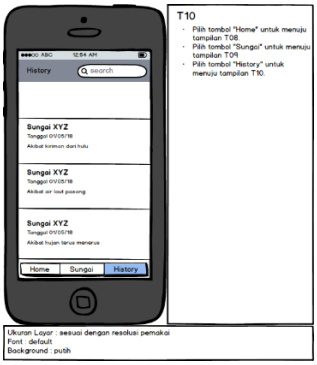


Figure 12 .Flood Data View

10. Detail Flood View

Detail flood view provides clarity of the page to see one of the flood data. Designing a detailed flood display interface can be seen in the Figure 13.



Figure 13. Detail Flood View

11. Notification View

Notification view provide clarity of the entry of notification notifications that the river will overflow to the public. Designing a notification display interface can be seen in the Figure 14.



Figura 14. Notification View

2.3.4 Relation Schema

Table relation schema is a table relation that is related to another table. Relationship Scheme The table contained in the application for recommendation for flood evacuation can be seen in the Figure 15.

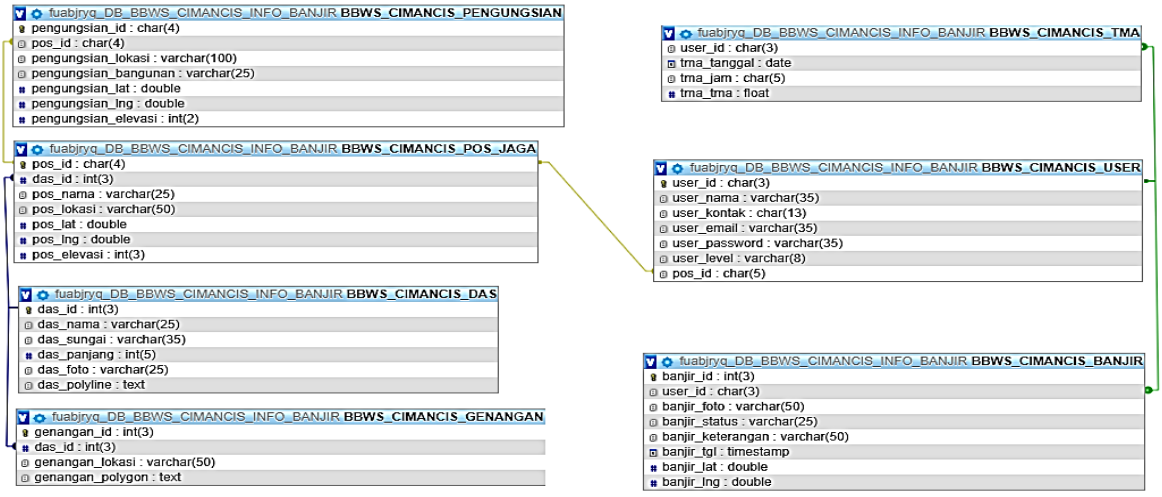


Figure 15. Relation Schema

2.4 Testing

After the evacuation recommendation application for the flood disaster has been implemented, then the system and application users are tested, the officers and the community. The test aims for software that is built that is tested and can run well without experiencing errors.

Based on the results of testing on the system with the black box method, it can be concluded that from all functional systems found a few errors, but generally the evacuation recommendation application system is in accordance with the objectives, whereas based on the results of application testing the user can conclude that this application can help deep river field officers Announcement of the river that will overflow and this application is enough to help the community in obtaining information on river overflows and some places of refuge.

3. CLOSING

3.1 Conclusion

Based on the results of the implementation and testing that has been carried out, the conclusion of the recommendation application of evacuation sites due to flood disaster in Cimanuk-Cisanggarung watershed is as follows:

a. Recommendation application for evacuation sites due to flood disaster can facilitate river field officers in terms of giving announcements or information to people who will be affected by floods due to overflowing rivers with photo evidence along with river overflow locations.
b. Recommended the application of evacuation sites due to flood disaster is enough to make it easy for people near the Cimanuk-Cisanggarung watershed to get information on river overflows and information on which places (recommendations) are used as refuge sites by being directed towards the intended location of the evacuation site..

3.2 Suggestion

In the construction of applications for the construction of recommendations for evacuation sites due to floods in the Cimanuk-Cisanggarung river basin, there are still many disadvantages. Following are suggestions for the development of this application for the future, namely:

a. The addition of SMS Gateway technology to overcome people who do not have an Android smartphone.
b. The addition of Internet of Things microcontroller technology in automatic TMA recording.
c. The addition of Weather API technology to maximize evacuation recommendations with the addition of weather and rainfall criteria.

REFERENCES

[1] A. Setiyadi dan E. B. Setiawan, "Sistem Informasi Pengumuman Program Studi Di Perguruan Tinggi X," *Lontar Komputer,* vol. 8, no. 1, pp. 11-21, 2017.

[2] F. D. Nurzam, I. N. Fajri dan D. Prabowo, "Rancang Bangun Aplikasi Media Laporan Aspirasi Dengan Firebase Cloud Messaging Berbasis Mobile," *Proseding Seminar Nasional Teknologi Informasi dan Multimedia 2017,* vol. 5, no. 1, pp. 37-42, 2017.

[3] W. Wijaya, H. Tolle dan A. P. Kharisma, "Rancang Bangun Aplikasi Geotagging Social Report Bencana Banjir," *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer,* vol. 2, pp. 2817-2824, 2018.

[4] J. A. J. L. Batu dan C. Fibriani, "Analisis Penentuan Lokasi Evakuasi Bencana Banjir dengan Pemanfaaan Sistem Informasi Geografis dan Metode Simple Addtive Weighting," *Teknologi Informasi dan Ilmu Komputa,* vol. 4, pp. 127-135, 2017.

[5] E. Juanianto dan M. Z. Zuhdi, "Penerapan Metode Palette untuk Menentukan Warna Dominan dari Sebuah Gambar Berbasis Android," *Informatika,* vol. 5, no. 1, pp. 62-73, 2018.

[6] SDA PU, "PERMEN PUPR No. 28 2015," [Online]. Available: http://sda.pu.go.id:8183/panduan/unduh-referensi-peraturan/PERMEN_PUPR_28_2015.pdf. [Diakses 9 4 2018].

[7] N. G. Perdana dan T. Widodo, "Sistem Pendukung Keputusan Pemebrian Beasiswa Kepada Peserta Didik Baru Menggunakan Metode TOPSIS," *Semantik,* vol. 3, no. 1, pp. 265-272, 2013.

[8] D. Nofriansyah, Konsep Data Mining Vs Sistem Pendukung Keputusan, Yogyakarta: Deepublish, 2014.

[9] T. Suryana dan Koesheryatin, Aplikasi Internet Menggunakan HTML, CSS, & JavaScript, Jakarta: PT Elex Media Komputido, 2014.

[10] Sommerville, Ian, Software Engineering. 9th, America: Pearson Aducation, Inc, 2011.