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# Design And Implementation Of Android And Gps Based Friend Application In Mitigation Efforts And Early Emergency Aid For Disaster Victims In Maternal And Neonatal Parents

**Author:**

***Juliana Munthe[1*], Siti Nurmawan Sinaga[2], Herna Rinayanti Manurung[3], Lidya Natalia Br Sinuhaji[4], Indra Manurung [5], Cantik Marlin Batee[6], Lisa Erawati Sibarani[7], Monica Situngkir[8], Nadya Nabila[9], Noni Indriani[10]***

[1]*Program Studi Kebidanan Program Pendidikan Profesi STIKes Mitra Husada Medan*
[2-3]*Program Studi Kebidanan Program Sarjana STIKes Mitra Husada Medan*
[4-5]*Program Studi Kebidanan Program Diploma Tiga STIKes Mitra Husada Medan*
*Corresponding Email: *munthejuliana@gmail.com*

**About the Author**

| | |
|---|---|
| 1st Author | : Juliana Munthe |
| Affiliation | : STIKes Mitra Husada Medan |
| Mailing address | : Jl. Pintu Air 4 Pasar 8 Kel. Kwala Bekala Kecamatan Medan Johor Kota Medan |
| Email of author | : munthejuliana1986@gmail.com |
| Orcid ID | : https://orcid.org/0000-0002-8866-7090 |
| Google Scholar URL | : https://scholar.google.com/citations?user=dUtQjckAAAAJ&hl=id |
| Phone number | : 085275676555 |

## *ABSTRACT*

*This study aims to analyze the design and implementation of the Friend application based on Android and GPS as an effort to mitigate and respond to early emergency situations for disaster victims, especially pregnant women and newborns. This vulnerable group often faces high risks during disasters due to limited mobility and lack of access to effective information and communication. This study uses a qualitative method with an observation and interview approach to the community in disaster-prone areas, health workers, and related parties at the Kampung Baru Health Center, Medan. The application development uses the UML (Unified Modeling Language) system, including use cases, activity diagrams, and sequence diagrams. The results of the study show that the Friend application is able to integrate emergency reporting, mapping of disaster-prone areas, and direct communication with health workers and the Regional Disaster Management Agency (BPBD). The trial showed that the application can determine the user's position with an average accuracy of 12.9 meters and a response time of 1.49 seconds, allowing for rapid handling of pregnant women and babies in emergency conditions. The implications of this study indicate that the application of digital technology in disaster mitigation can increase the effectiveness of emergency responses for vulnerable groups, as well as accelerate coordination between the community, medical personnel, and authorities. Friend is expected to be an innovative solution in improving the safety of mothers and babies in disaster situations.*

Keywords: *mitigation, early emergency, disaster, maternal, neonatal*

***ABSTRAK***

Penelitian ini bertujuan untuk menganalisis perancangan dan implementasi aplikasi FRIEND berbasis Android dan GPS sebagai upaya mitigasi dan tanggap darurat dini bagi korban bencana, khususnya ibu hamil dan bayi baru lahir. Kelompok rentan ini sering menghadapi risiko tinggi saat terjadi bencana akibat keterbatasan mobilitas serta kurangnya akses informasi dan komunikasi yang efektif. Penelitian ini menggunakan metode kualitatif dengan pendekatan observasi dan wawancara kepada masyarakat di daerah rawan bencana, tenaga kesehatan, serta pihak terkait di Puskesmas Kampung Baru, Medan. Pengembangan aplikasi menggunakan sistem UML (Unified Modeling Language), termasuk use case, activity diagram, dan sequence diagram. Hasil penelitian menunjukkan bahwa aplikasi FRIEND mampu mengintegrasikan pelaporan darurat, pemetaan daerah rawan bencana, serta komunikasi langsung dengan tenaga kesehatan dan Badan Penanggulangan Bencana Daerah (BPBD). Uji coba menunjukkan bahwa aplikasi dapat menentukan posisi pengguna dengan akurasi rata-rata 12,9 meter serta waktu respons 1,49 detik, memungkinkan penanganan cepat bagi ibu hamil dan bayi dalam kondisi darurat. Implikasi penelitian ini menunjukkan bahwa penerapan teknologi digital dalam mitigasi bencana dapat meningkatkan efektivitas respons darurat bagi kelompok rentan, serta mempercepat koordinasi antara masyarakat, tenaga medis, dan pihak berwenang. FRIEND diharapkan menjadi solusi inovatif dalam meningkatkan keselamatan ibu dan bayi dalam situasi bencana.

Kata kunci: mitigasi, tanggap darurat dini, bencana, maternal, neonatal

## INTRODUCTION

Disasters are a threat to cities in Indonesia and in the world. Natural disasters can cause great social and economic losses. The most visible impact is the loss of life. Geological and Hydrometeorological, Demographic, Sociological and Historical conditions of Indonesia are disaster-prone areas and the highest in the world (Pratama et al., 2024; Yulianto et al., 2021). Vulnerable conditions such as pregnant women, mothers in labor, postpartum mothers and babies often become victims of disasters, this is due to one of the lack of information and participation in disaster mitigation socialization so that they have almost no ability to save themselves when a disaster occurs, women are 14 times more at risk of dying during a disaster than men. Women and children are vulnerable to becoming victims of trafficking because many family members are separated from each other during the evacuation period and the economic crisis due to disasters. The Importance of Mitigation as an Effort to reduce disaster risk both through physical development, as well as awareness and increased ability to face the threat of disaster (Kementerian Sosial, 2022). According to BNBP data (2022), Indonesia experienced 3,544 disasters consisting of 1,531 floods, 1,068 extreme weather events, 634 landslides, 252 forest and land fires, 28 earthquakes, 26 extreme waves and abrasion, 4 droughts, and 1 volcanic eruption. A total of 6,144,324 people suffered and were displaced, 861 people died, 46 people were missing, and 8,727 people were injured as a result of disasters in 2022.

No one can predict when and where someone will experience an emergency that requires immediate assistance. Delayed treatment can lead to physical disability or even death. It was recorded that in December 2023 Indonesia experienced disasters such as floods, landslides, strong winds, extreme weather, volcanoes, forest and land fires. Kupang, floods had to be broken through by mothers in labor to be referred to adequate facilities (Fitri Awaliyah et al., 2022). Demak Central Java, a baby was swept away 300 meters from home and was found dead and floating due to the flood. The Medan City Regional Disaster Management Agency recorded 484 natural disasters in the region throughout 2023. A total of 131 landslides, 138 floods, 105 forest and land fires, 79 tornadoes, and 11 floods, Deli Serdang Regency experienced the most disasters, namely 79 disasters. Emergency Handling of pre-health care facilities is an act of providing assistance to patients quickly and appropriately at the scene before receiving action at a Health Care Facility (Arthana & Ismail, 2019; Kurniawan, 2015). Guided by rapid response, emergency handling of pre-health care facilities is carried out by health workers at the Integrated Safety Service Center (PSC) 119 or the nearest Health Care Facility, and can involve the general public with the help of operators. The success of emergency handling of pre-health care facilities depends, among other things, on the existence and capability of access and communication (Kementerian Kesehatan, 2018; Wiharti et al., 2020).

The main problem in this study is the high risk faced by vulnerable groups, especially pregnant women, mothers in labor, postpartum mothers, and infants, when a disaster occurs. This group often experiences difficulties in saving themselves due to limited mobility and lack of socialization of disaster mitigation, which makes them unprepared to face emergency situations. In addition, access to emergency health services is also an obstacle, considering that in disaster conditions many health facilities are affected or difficult to reach. This is further exacerbated by the emergency reporting and handling system, which is still manual and not well integrated, causing delays in communication between the community, health workers, and the Regional Disaster Management Agency (BPBD). On the other hand, although the development of digital technology is increasingly rapid, its use in disaster mitigation and handling for pregnant women and infants is still very limited. Most of the emergency response applications currently available focus more on general reporting without specific features that can help this vulnerable group get help faster. Previous studies also discussed more about early warning systems compared to rapid response systems that are able to connect victims, health workers, and BPBD in one integrated platform, as stated in the research results of (Arifin, 2016; Aziz, 2024).

Based on these problems, this study aims to analyze the planning and implementation of the FRIEND application based on Android and GPS to improve disaster mitigation and emergency response for disaster victims in mothers and newborns in the Kampung Area of the New Health Center in Medan City. Based on data sources from the Kampung Puskesmas Baru, it is a river basin (DAS) that often experiences natural disasters such as floods. In this river basin there are pregnant women and babies; the number of pregnant women in 2023 was 423 people in the Kampung Area of the New Health Center. On September 16, 2023, there was a flood, which had an impact on the health of pregnant women and babies. Residents of the Kampung Puskesmas Baru have 6 sub-districts, namely Pasar Daerah Senen, which is a river basin that is the locus in this study because it often experiences floods. Because one of the main factors causing high risk for this vulnerable group is the delay in emergency response due to lack of access to information and effective communication when a disaster occurs. FRIEND is present as an innovative solution designed to improve disaster mitigation and emergency response for pregnant women and neonates by utilizing Android and GPS-based technology. This application allows the public to quickly report emergency conditions, obtain information about disaster-prone areas, and connect them with health workers and the Regional Disaster Management Agency (BPBD). With location mapping features and real-time reporting systems, FRIEND not only accelerates the evacuation and medical treatment process but also increases the effectiveness of coordination between health workers and disaster management agencies. Therefore, the implementation of FRIEND is expected to be a strategic solution in reducing the risk of death and other negative impacts for pregnant women and babies during a disaster. Indriasari et al., (2017), in her research, also said that the mobile platform is an application that uses the GPS function provided by smartphones to search for the coordinates of the volunteer's location and then sends the location data automatically and manually. The web platform is used to receive volunteer location data and display it on Google Maps so that disaster management coordinators can monitor their positions and search for volunteers more quickly.

## METHOD

In its implementation, the FRIEND (Maternal and Neonatal Emergency Response) mobile application is designed and implemented on a smartphone based on the Android Operating System with the needs of a computer network, internet and community data in disaster-prone areas. This system and application were tested with health facility centers in the form of health centers, health centers and hospitals in Medan City which are integrated with ODP and PDP data in a database. The design of the FRIEND (Maternal and Neonatal Emergency Response) mobile system and application can generally show that there is communication between the community and health workers through ODP and PDP smartphones which are forwarded to the server at the Kampung Baru Health Center and

then directed to the smartphones of medical officers and the Regional Disaster Management Agency. The working principle of the system and technology is in accordance with the scheme in Figure 4.

The data analysis used in this research method is qualitative research whose data results are obtained from observations and interviews with objects (Maleong, 2019; Sugiyono, 2022). The results of the data processing are reviewed to make it easier when designing Android-based disaster mitigation applications. In addition, the development method created for this Android-based disaster mitigation application uses the UML (*Unified Modeling Language*) system design. This UML consists of use cases, activity diagrams and sequence diagrams.

## RESULTS AND DISCUSSION

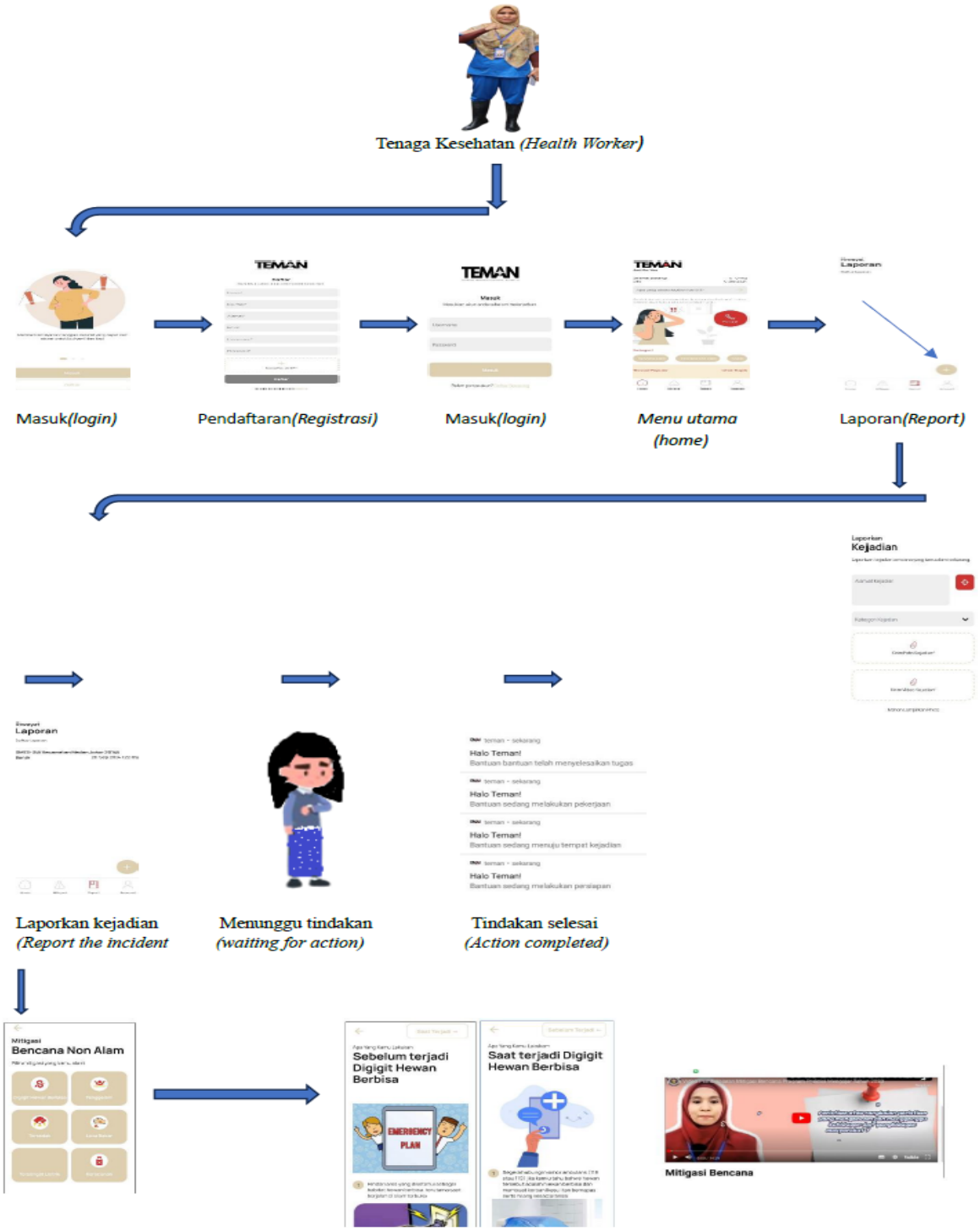
The FRIENDS application is designed with an Android-based system and GPS capability to integrate emergency reporting, mapping areas vulnerable to disaster, and direct communication with the power health and body countermeasures of the Regional Disaster Management Agency (BPBD). The design system uses a UML (Unified Modeling Language) approach, including use case diagrams, activity diagrams, and sequence diagrams to ensure optimal functionality. The FRIENDS system consists of a number of main components, namely mobile applications used by the public for reporting emergency conditions, getting information about vulnerable disaster areas, and contacting power medical and BPBD. Central server functioning for accepting reports from users, processing data, as well as continuing information to the party related. The GPS system allows tracking the user's location in real-time to ensure accurate location in an emergency incident, while the admin dashboard is used by power medical and BPBD officers to monitor incoming reports and to coordinate responses.

The channel work system started when the user entered the application and accessed the feature reporting emergency. The GPS system detects the user's location in an automatic way, and a report is sent to the central server, which is then forwarded to Power Medical and BPBD. Party-related accept report via the admin dashboard and quickly give a response while the user gets a notification regarding the report status and estimated time response. In this design, various UML diagrams are used, such as use case diagrams that describe interaction between the user, power medical, BPBD, and system application. The activity diagram shows channel activity starting from reporting until handling emergencies, while the sequence diagram illustrates communication inter-component in the system to ensure fast response and accuracy.

### System Design

In designing a disaster mitigation application system using use cases, activity diagrams, and disaster mitigation sequence diagrams, Figure 1 shows a use case diagram from the community user side. This use case illustrates that the community can only access the login feature, response point mapping, and disaster reporting features. The use case diagram design from the volunteer user side is used to design a disaster mitigation application. This use case illustrates that Health Workers can access the login feature, response point mapping, health worker activity reporting features, and disaster reporting features. The difference between these two use cases can be seen in the following figure.

**Figure 1. Use Case Diagram**

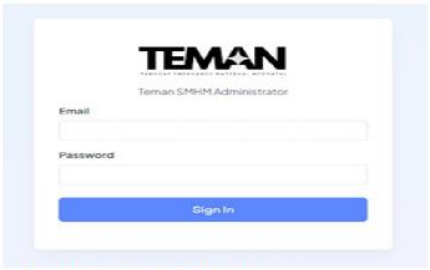



*Edukasi Mitigasi Bencana dan Penanganan Kegawatdaruratan Maternal Neonatal (Disaster Mitigation Education and Handling Emergency Maternal Neonatal)*

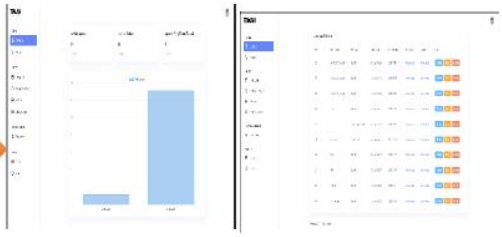
*Gambar 3 Use Came Diagram Tenaga Kesehatan*

**Admin Use Case**

Figure 4 is a use case diagram design from the admin user side. This use case illustrates that the admin can access everything in the disaster mitigation application.

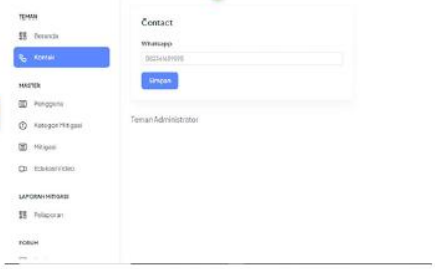



Admin Dashboard Guide ( Login)

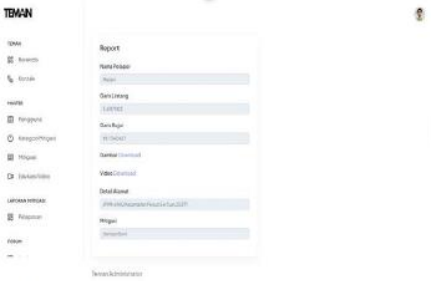


Dashboard (jumlah laporan, laporan yang selesai, dan yang belum selesai)
Dashboard (number of reports, reports that finished, and unfinished)

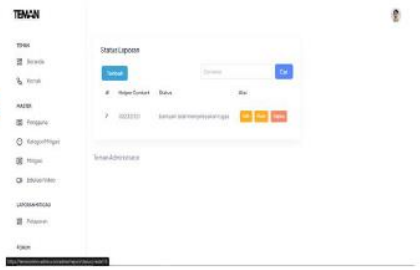
Halaman Pengguna (User Page)



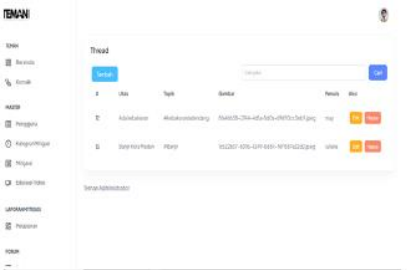
Mitigasi (Mitigation)



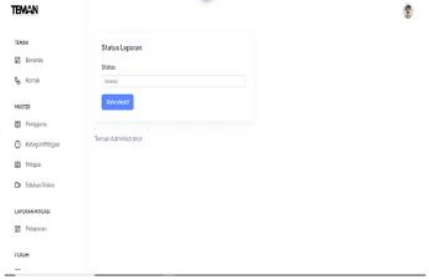
Halaman Report ( Report Page)



Halaman Report ( Report Page)



Halaman Topik Forum (Forum Topics Page)

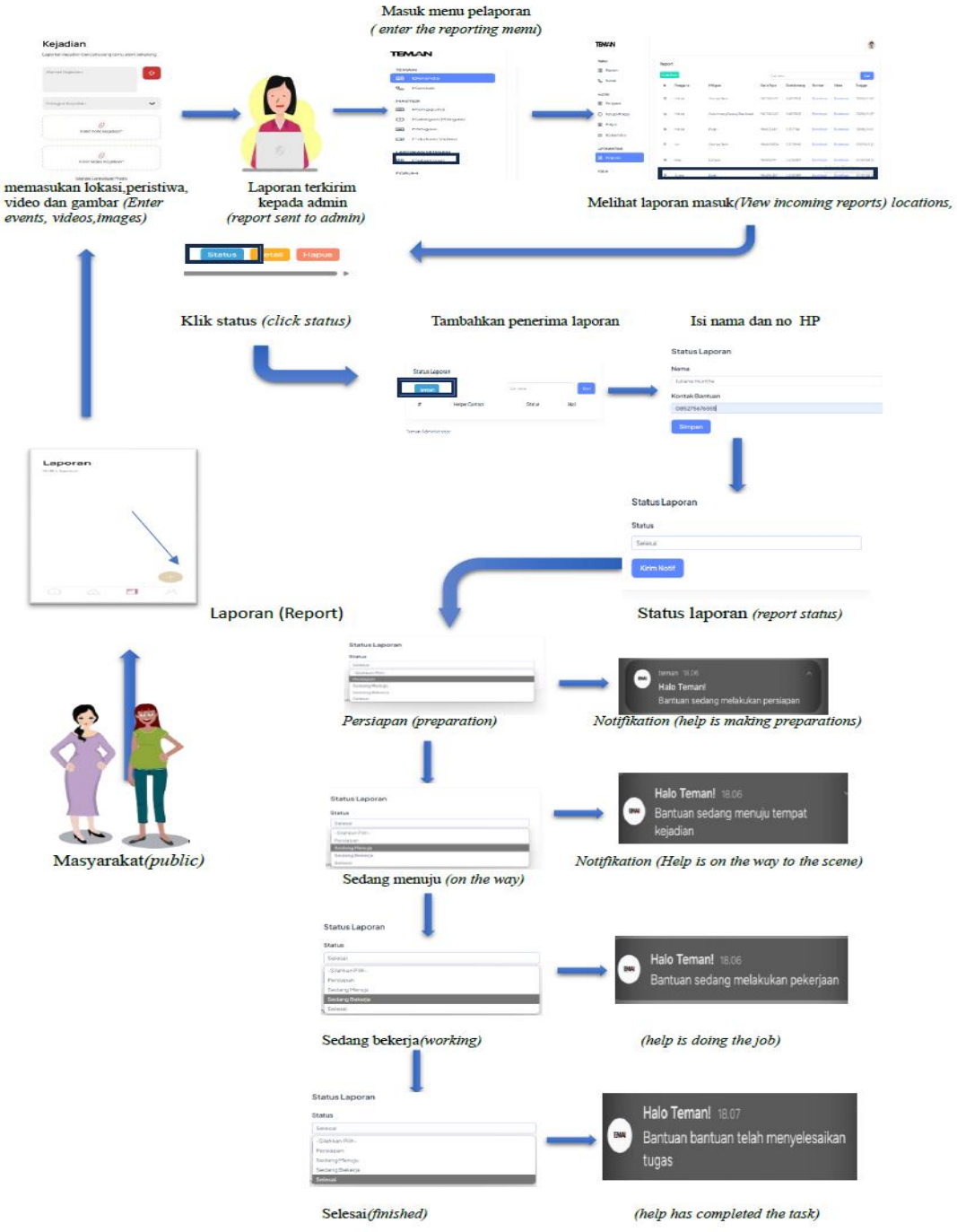


Halaman Utas Forum (Forum Thread Page)

*Gambar 4. Use Came Diagram Admin*

**Sequence Diagram Activity**

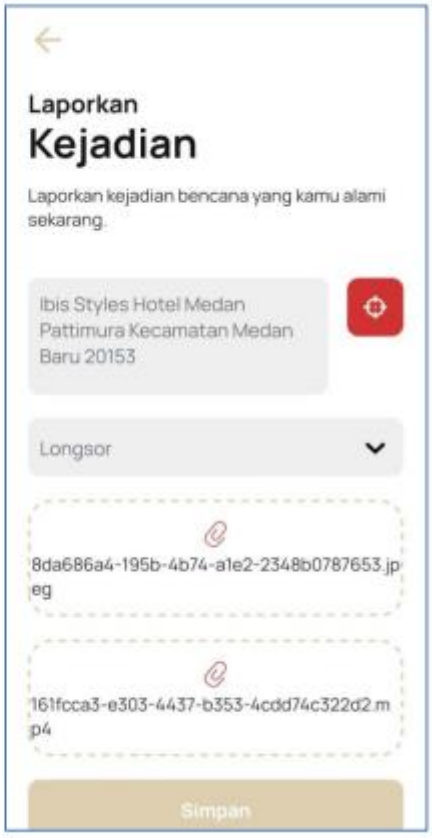
The design of the sequence diagram of reporting volunteer activities during disaster response explains that every actor who selects this feature will be shown the activity report page in the form of a form. Furthermore, the actor can add activity reports that can be viewed.




*Gambar 5 Sequence Diagram Lapor Bencana*

**Application Submission**

The application can be used after submitting or registering the application. Submitting the application can be done in several steps: *First, register.* On this page, you can see several components such as the call button, categories, and also the mitigation menu, reports, and accounts. The call button will direct you to the admin officer's WhatsApp page, whose number is stored on the admin web in the contact menu. *Second,* the selection of mitigation that the public can choose to see education or disaster management that occurs. After the user/community selects a mitigation category, mitigation from the selected mitigation category will appear, such as natural disasters, non-natural disasters, social, and so on. When mitigation is selected, a detailed disaster mitigation or prevention page will appear, and there is a button in the upper right corner to select events such as when the incident occurred and before the incident occurred.


Above is the report page; it can be seen that the first page that appears above is the report data page and also the button to report the disaster. When the add button is pressed. Then the reporting form will be displayed with several inputs such as address, type of disaster, incident images, and videos.

Results from testing the application show that the application can determine the user's position with an average accuracy of 12.9 meters. Testing was done with the comparison of the location detected by the user by application with the coordinates. Actually, it shows a level of sufficient accuracy to support a fast in an emergency situation. Besides that, the time response average system is 1.49 seconds, which means the application is capable of sending a report of an emergency in a very short time. This is to allow power medical and BPBD officers to quickly accept information about the condition of the user and take necessary actions. The application is also designed to give notifications of emergencies in real-time to power medical and party-related matters, ensuring that every incoming report can be followed up with fast and efficiently.

In simulations performed, users can easily access the feature of reporting emergencies and get a response fast from the officer medical. Simulation is done with various scenarios, such as a disaster flood, landslide, and earthquake, to test the effectiveness of the application in various situations. Feature mapping shows a location area vulnerable to disaster in a way that accurately displays a dot, dot, dot, and dangerous and location post health closest. Users also can see track recommended evacuation, helping them to quickly go to a better, safer place. System communication in the application makes it easier to coordinate between society, energy, medical, and BPBD with the existence of instant messaging and automatic notifications. This allows for more effective communication and speeds up the retrieval process decision in handling emergencies.

**Discussion**

The results of this study indicate that the use of digital technology in disaster mitigation can increase the effectiveness of emergency responses for vulnerable groups. The FRIEND application not only provides a fast emergency reporting feature but also allows mapping of disaster-prone areas that can be accessed by the community, medical personnel, and authorities. With this feature, the community can be more aware of potential disasters that may occur in their environment.

One of the main advantages of the FRIEND application compared to the previously used manual system is the higher response speed. With the real-time tracking feature, victims can immediately get help without having to wait long. The application interface is also designed to be simple so that it is easy to use by the general public, especially for vulnerable groups such as pregnant women and babies. In addition, this application provides a centralized database that records all reported emergency cases, allowing for more systematic monitoring of victim status. This study supports several previous studies, namely research conducted by Aryansa et al., (2019), which states that the rapid development of mobile technology, the use of technology that can be used by the community to share disaster information, is sharing disaster locations and geospatial information by utilizing geotagging and push notification features in real time. Simanjuntak et al., (2019) also stated that by utilizing geotagging technology, a mobile application can be designed to add location points for natural disaster emergency response facilities. So that users can find the location of natural disaster emergency response facilities easily and the coordinator of each location field can process data from each facility that will be added. By utilizing the Polylines algorithm, it can be used as a route search to get to the location of the facility.

However, the implementation of this application also faces several challenges. One of the main obstacles is limited internet access in disaster-prone areas, which can hinder the performance of the application in emergency conditions. In addition, the level of digital literacy among the community is also an important factor that needs to be considered, considering that not everyone is used to using application-based technology in everyday life. Therefore, an education and socialization program is needed so that the community can understand how to use the FRIEND application effectively.

Coordination with related parties, such as local governments and medical personnel, is also a crucial aspect in the successful implementation of this application. The FRIEND application must be supported by policies that ensure the involvement of all parties in utilizing this technology to the maximum. With strong support from various stakeholders, this application can be an innovative solution in improving emergency preparedness and response for pregnant women and babies in disaster situations.

## CONCLUSIONS AND SUGGESTIONS

In this study, the results of the design of a rapid assessment application that can be used by the rapid response team (rescue team) to record disaster victims so that the allocation of medical resources can be done immediately even before the victims reach the hospital have been presented. In addition, a rapid assessment application was also developed to record the number of victims, especially maternal

and neonatal. Both of the rapid assessment applications above are implemented in mobile communication devices so that they can be carried by members of the rapid response team or officers to the field. In this study, the design of an SMS (Short Message Service) communication infrastructure via Open BTS-based mobile phones has also been presented, which can be used by disaster victims to report their whereabouts via mobile phones.

The scenario in the testing implemented in this study is to provide an account to each user in this case ODP and PDP which are stored in a database. So, it is assumed that only users registered by the Health Center on the ODP and PDP criteria can use the application. The technical implementation of the system and application is shown in Figure 5. Figure 5 (a) shows the login process of a user by entering their username and password. Meanwhile, Figure 5 (b) is the initial page after the login process is successful. This application can determine the position of the health center according to the user's geographic location based on the coordinates where a user is located. As seen in Figure 5 (c) the green dot is the position of the ODP user and the purple dot is the position of the nearest health center that can be contacted by the user. Figure 5 (d) is the process of a telephone call made by the ODP to the call center of the nearest health center.

After implementing the design, creation and testing of the system, it was concluded that the FRIEND (Maternal and Neonatal Emergency Response) application can run well which can show a person's position such as the location of the OTG in real time with an average distance accuracy of 12.9 m from the actual distance and an average response time of 1.49 seconds. The application can map disaster-prone areas and immediately get help, especially for maternal and neonatal.

The implications of this study include improving faster and more targeted emergency responses for vulnerable groups, accelerating coordination between the community, health workers, and related agencies, and empowering the community through disaster mitigation education. In addition, this application also contributes to improving the efficiency of medical resource allocation with an accurate and real-time reporting system. The success of this application depends not only on the reliability of the technology but also on continuous evaluation and adaptation to remain effective in real-world scenarios. To ensure its effectiveness, regular monitoring of the application's performance is needed, including GPS accuracy, response speed, and communication efficiency. Further development can also include integration with national emergency service systems, such as PSC 119, as well as the application of artificial intelligence (AI) technology and big data analysis to improve disaster risk prediction. In addition, the sustainability of this application requires policy support from the government, health institutions, and humanitarian organizations in the form of regulations, funding, and synergy with national disaster management policies. Overall, this study confirms that the use of digital technology in disaster mitigation can improve the safety of pregnant women and newborns. However, the success of its implementation is highly dependent on continuous evaluation and adaptation. With technological improvements, emergency system integration, and support from various parties, this application has the potential to be an effective solution in facing future disaster challenges.

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