Risnawati Tanjung

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DEVELOPMENT OF THE ANDROID-BASED APPLICATION OF BETAPA ANTIK VERSION 2.0 TO SUPPORT SURVEILLANCE AND CONTROL OF DENGUE FEVER

Risnawati Tanjung [1] , Helfi Nolia [2] , Jernita Sinaga [3] , Adristi Wina Damanik [4] , Deli Syaputri [5,] Samuel Marganda H Manalu [6] , Nelson Tanjung [7]

Department of Environmental Health, Health Polytechnic, Ministry of Health, Medan, Indonesia

Email correspondence: risnawatitanjung75@gmail.com

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Abstract

Dengue fever is an endemic disease that causes serious health problems in Indonesia, especially in tropical areas such as North Sumatra. The increasing incidence of dengue fever highlights the need for innovative technology-based efforts to support more effective vector monitoring and control. The objective of this research is to develop the BETAPA ANTIK (Based on Larvae Surveillance and Analysis Technology) application version 2.0, which can facilitate location tracking, digital reporting, public education, and adult mosquito identification to support control. This research uses the Waterfall software development method, which consists of the phases of requirements analysis, system design, implementation, testing, and maintenance. Application testing was conducted using a black box testing approach to evaluate the system's functionality and reliability. The results show that the BETAPA ANTIK application version 2.0 has superior features such as a GPS camera for location tracking, an adult mosquito identification camera, and educational media in the form of videos and posters. This application also simplifies the process of reporting cases by the public and health workers in real-time through integration with WhatsApp and Gmail services. Although it still has limitations, such as dependence on an internet connection, this application has been proven capable of supporting early detection and rapid intervention in DF control. Therefore, the BETAPA ANTIK version 2.0 application is an effective digital solution for increasing public participation and increasing the efficiency of healthcare workers. Suggestions for further development include the addition of an offline mode, a risk zone notification feature, and the inclusion of an integrated monitoring system so that the application can be implemented more widely and optimally in various regions.

Keywords: BETAPAANTIK, Vector, Dengue Hemorrhagic Fever

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is a tropical disease that is a global health problem and is endemic in many countries, including Indonesia. This disease is caused by the dengue virus which is transmitted through the bite of the Aedes aegypti and Aedes albopictus mosquitoes [1] . Based on the latest WHO report, DHF continues to show an increasing trend in incidence in various tropical regions, with a significant disease burden especially in Southeast Asia [2] . In Indonesia itself, DHF is one of the main causes of morbidity and mortality due to infectious diseases, with the incidence rate tending to increase every year [3]*

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The increase in dengue fever cases is influenced by various factors, including global climate change which has an impact on vector behavior and geographic distribution, rapid

urbanization, and suboptimal environmental sanitation quality. [4] [5] . The North Sumatra region, especially Deli Serdang Regency, is an area with high reports of dengue fever cases due to humidity and population density which support the breeding of mosquito vectors [3] . These conditions create challenges for controlling this disease, especially in terms of monitoring and rapid and targeted intervention.

Mosquito nest eradication (PSN) efforts and the implementation of the 1 House 1 Mosquito Larvae Movement (G1R1J) are national strategies in controlling dengue fever that rely on active community participation [6] . However, the application of traditional methods in monitoring mosquito larvae and reporting cases often faces obstacles such as a lack of accurate documentation and slow responses due to manual systems. Therefore, information technology-based innovations, especially mobile applications, are a promising alternative in increasing the effectiveness and efficiency of vector surveillance and early reporting.

The use of smartphone-based applications based on location and multimedia can facilitate real-time reporting, educate the public, and identify adult mosquito species interactively [7] [8] . As an open and rapidly developing platform, Android provides great opportunities in the development of health applications that are easily accessible and used by field officers and the general public. [9] . With the support of GPS features, cameras, and integration of social media and instant messaging services, mobile applications can increase active community participation while accelerating the response of health workers to the risk of dengue fever [10] .

METHOD

The research method used in the development of the BETAPA ANTIK version 2.0 application is descriptive research with a Prototyping Method approach to obtain direct input and evaluation from system users. The software development process follows the Waterfall model consisting of the stages of needs analysis, system design, coding and testing, integration, and application maintenance. In the needs analysis stage, data is collected about the features expected by users through interviews and literature studies. The system design phase produces a user interface (UI) design, client-server system architecture, and database design appropriate to support application operations. Implementation is carried out by programming using the Kotlin/Java language on the Android platform, followed by functionality testing through black box testing to ensure all features function according to specifications. Testing also assesses the usability and performance aspects of the application. After the application is released, regular

maintenance is carried out to fix bugs, improve features, and update educational content to ensure the application remains effective and reliable in supporting Dengue Hemorrhagic Fever control through information technology-based monitoring and reporting.

RESULTS AND DISCUSSION

Location Determination

Location tracking, in the use of this information technology feature, functions to collect, record, and analyze locations related to the spread of dengue fever cases. The location feature is placed on the health center page. In the display of 26 health center locations, there are 3 questionnaire options and the contents of the questionnaire itself have been given a location tracking feature, namely a GPS camera. The function of the GPS Camera in this application is to help identify the location of dengue fever cases and detect potential mosquito breeding points based on real-time data. The real-time data display itself is in the form of an address or location that has been marked, GPS coordinates (latitude & longitude) and the time of collection (day/date/hour).

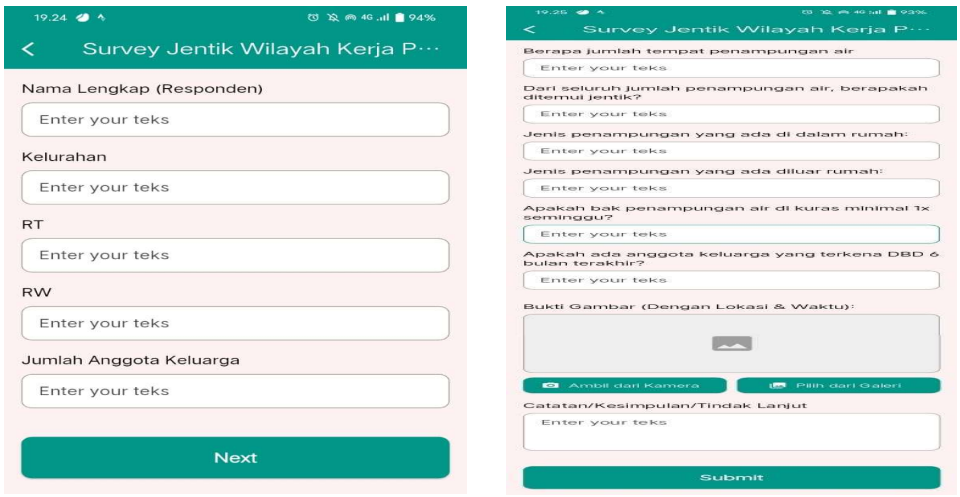

Figure 1. *Location*

Reporting

The Reporting feature is one of the important components discussed in the development of this application. This feature acts as a bridge between the community, health workers, and the dengue data management system, with the aim of accelerating disease detection, response, and control. In terms of function, the reporting feature differs from monitoring in that priority scale. This dengue case reporting makes it easier for the public to report dengue symptoms or confirmed cases in their environment, so that coordination of dengue response times will be responsive to compliance with dengue issues at priority locations according to existing reports.

The reporting page uses third-party platforms such as WhatsApp and Gmail. When using these third-party platforms, the number and email address of the responsible Coordinator of the 1 House 1 Jumantik (G1R1J) Movement at each health office are included. This reporting method can also be accompanied by uploading evidence or documentation in the form of environmental conditions (air puddles, air reservoirs, and TPS) and including the time the incident/symptoms first appeared in the environment, making the reporting process easy, fast, and digitally documented.

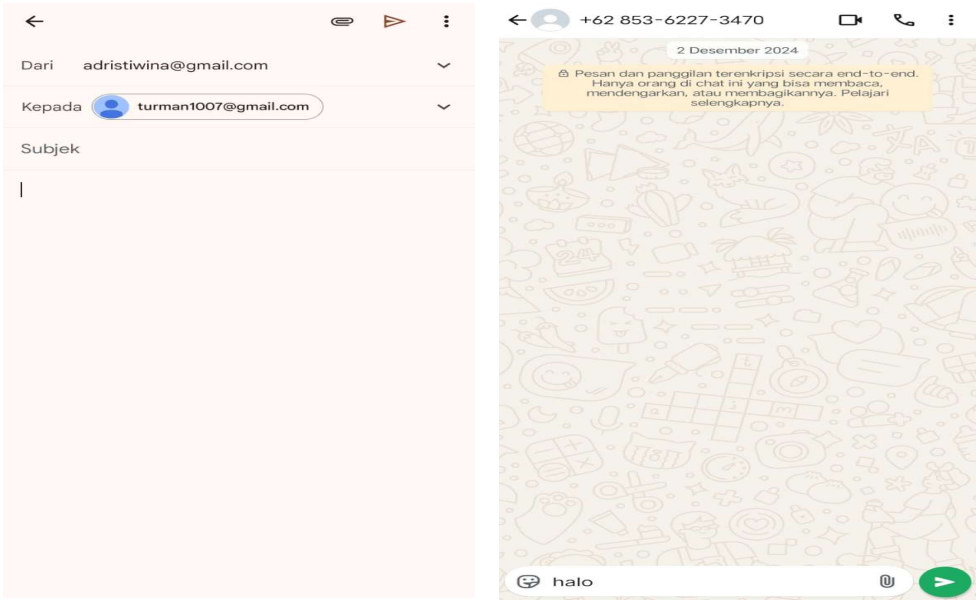

Figure 2. *Reporting*

Education

The educational feature is an important part of the application which functions to increase public knowledge, awareness and involvement in preventing and controlling the spread of dengue fever.

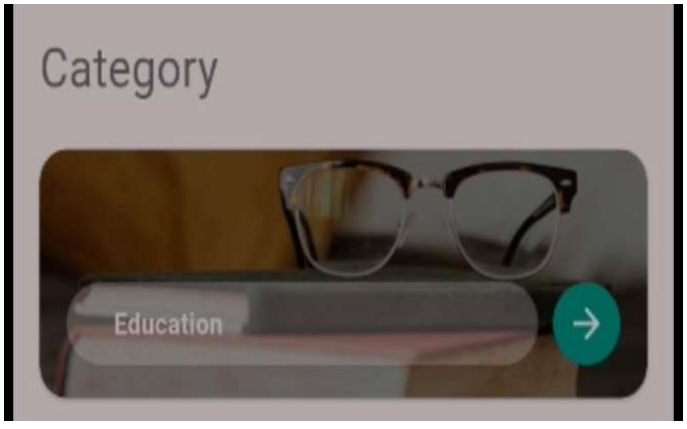

Figure 3. *Education*

Poster

The educational posters in version 1.0 and version 2.0 have some similarities in the mosquito life cycle and mosquito nest eradication (PSN) sections, but what differentiates them is that the posters look more attractive. These educational posters serve to provide information that is quickly read and understood by all ages. This educational page also displays very modern features such as story circles on several applications (*Instagram Story*) which is a feature that functions to explain all types of mosquitoes, their characteristics, and their preferences. On this educational page there will also be special displays such as a guidebook regarding information on Dengue Hemorrhagic Fever (DHF), the mosquito life cycle, behavior in preventing and controlling mosquito breeding, and Mosquito Nest Eradication (PSN).

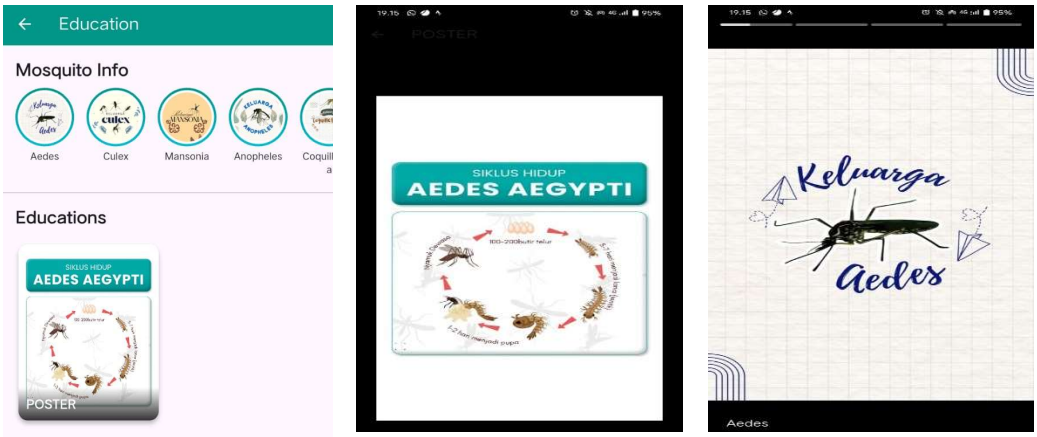

Figure 4. *Poster*

Video

In addition, in ver 1.0 there was no educational video feature [11] so that in ver 2.0 in the development of this application already has an educational video feature. This educational video aims to convey information with attractive and memorable visuals in order to encourage community behavior through education that is easy to understand and apply in their environment. Indirectly, this educational video helps the community to become active agents of dengue prevention and becomes an informative and interactive learning media such as, functioning to motivate the community in changing waste into traps for adult mosquitoes and larvae, so that there is no increased mosquito breeding so that it can help reduce the number of dengue fever incidents in all residential areas. In this educational video feature, admins/health workers can play an active and creative role in educating the community in maintaining environmental sanitation and preventing mosquito breeding in all health center work areas by making interesting promotional videos/educational videos/drama videos so that the community will also actively participate in PSN activities.

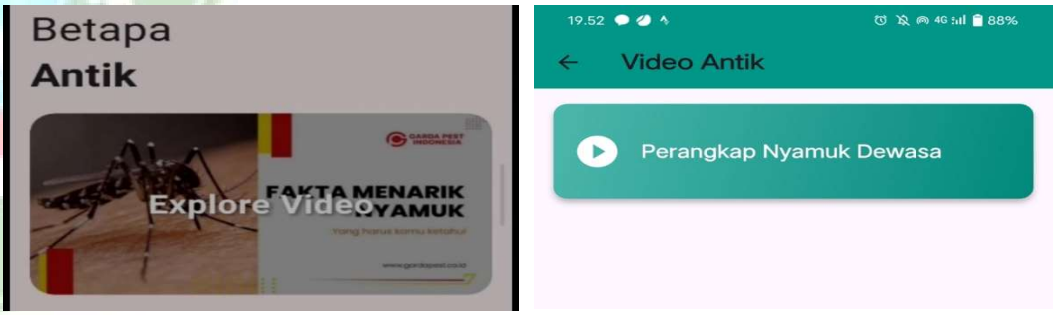

Figure 5. *Video Image*

Identification Camera

In the first version, there was no camera feature for detecting adult mosquitoes. Therefore, in the second version of the application, this identification feature became a key feature. The camera function detects adult mosquitoes so that the application can analyze images and help recognize 23 types of mosquitoes, namely, *Aedes Aegypti, Aedes Albopictus, Aedes Butleri, Aedes Amesii, Armigeres, Culex Quinquefasciatus, Culex Gelidus, Culex Sitiens, Culex Tritaeniorhynchus, Anopheles Sundaicus, Anopheles Maculatus, Anopheles Tessellatus, Anopheles Sinensis, Mansonia Bonneae, Mansonia Uniformis, Coquillettidia Nigrosignata, Coquillettidia Crassipes, Aedeomyia, Malaya, Toxorhynchites, Zeugnomyia, Uranotaenia, Tripteroides* (Ministry of Health of the Republic of Indonesia, 2019), so that they can be physically educated about the characteristics of dengue mosquitoes and those not called dengue mosquitoes in this feature. This recognition camera feature is a modern educational-interactive approach for users of the BETAPA ANTIK ver 2.0 application. How to use this camera feature is similar to how to use a camera on *a smartphone* , namely, press the camera button > point the camera at the mosquito you want to detect > press the small circle button on the screen to take a screenshot > the screen display will automatically change to the results of the type of mosquito that has been detected. If users want to know the explanation of the type of mosquito that has been detected, users can immediately go back to the home page and enter the education feature.

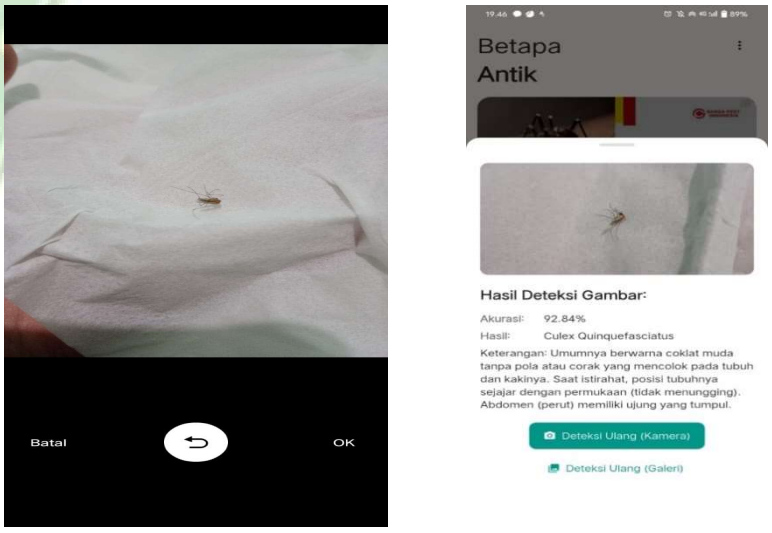

Figure 6. *Camera Identification*

ANALYSIS OF DEVELOPMENT RESULTS

The Development Life Cycle (SDLC) is a framework that describes the stages in the software development process. In developing the BETAPA ANTIK ver 2.0 application, the *Waterfall method* was used because of its systematic flow and its suitability for needs that are clearly defined from the outset. The stages include:

a. Needs Analysis Stage

The analysis of the needs of the BETAPA ANTIK application was developed by showing the need for an application that not only combines the presence of larvae, but is also able to record and report early symptoms of Dengue Hemorrhagic Fever (DHF), provide independent community education and provide early notification to health workers.

b. System design stage

The design analysis was conducted based on functional and non-functional requirements. This stage included analysis of the user interface (UI) design, system architecture (*client-server*), basic data design for storing user profiles, reports (questionnaires), locations, etc., and flowcharts for the reporting and notification process. The design was created with ease of use by the general public and efficiency for healthcare professionals in compiling reports.

c. Implementation Stage

The application was developed using the Android platform with the Kotlin Java programming language. The features described at this stage include report input (questionnaires), photo and location uploads (GPS-based), and interactive educational

content in the form of text and video, which are presented sequentially according to the modules developed during the design stage.

d. Testing Phase

The analysis conducted at this stage used *black box testing* to ensure that functions functioned as planned, such as the reporting feature was successfully used without errors, notifications were received properly by officers, and image location data was successfully saved. The test results, which included functionality, usability, and performance testing, showed the application worked functionally, was also easy to use, and had stable performance, although some minor shortcomings were found, such as its dependence on a stable internet connection.

e. Maintenance Stage

At this stage, the results obtained after the application has been tested are analyzed. Regular monitoring is conducted to fix bugs and improve features based on user feedback, including regular updates to educational content, user-friendly interface adjustments, and fixes for *crash* or *error reports* . Therefore, maintenance at this stage is crucial for ensuring long-term application usage.

ADVANTAGES AND DISADVANTAGES

Superiority

The BETAPA ANTIK application has several advantages that distinguish it from similar applications.

1. Identification features of Adult Mosquitoes

This app provides a feature for identifying adult mosquito species through visual documentation. Users can photograph any mosquitoes they encounter and, based on available guidance, identify whether they are potential dengue vectors (*Aedes aegypti* or *Aedes albopictus*). This feature helps increase public awareness and vigilance regarding their surroundings.

2. Camera GPS Based Location Tracking

By utilizing GPS and a camera, users can submit comprehensive reports, including location coordinates and visual documentation, in real time. This feature makes it easier for health workers to map the distribution of cases or potential cases and respond quickly and effectively.

3. Video and Poster-Based Educational Media

BETAPA ANTIK presents educational content in the form of interactive videos and digital

posters, which users can access anytime. This visual approach is considered more effective in conveying information than text alone, especially for communities with varying levels of digital literacy. Educational materials include dengue fever prevention methods, 3M Plus, and environmental hygiene guidelines. These advantages strengthen the BETAPA ANTIK application's position as a tool for early detection and participatory field-based data intervention.

Weakness

The development of this application also addressed several important limitations to convey the objective: its reliance on internet access. All of BETAPA ANTIK's key features, such as uploading photos, collecting on-site survey data, and accessing educational content, require a stable internet connection. This presents a particular challenge for users in areas with low or uneven connectivity. This can limit the app's effectiveness, particularly in rural or remote areas.

APPLICATION INTEGRATION

This integration is key to ensuring that data collected from the community is not only stored but also actively used in decision-making and rapid action in the field. The BETAPA ANTIK application generates invaluable data, such as dengue fever symptom reports from residents, photographic documentation of environments with potential mosquito larvae, and GPS-based incident locations. This data can be directly utilized in the dengue fever surveillance system at community health centers, allowing officers to more quickly identify clusters of vulnerable areas, prioritize interventions, and carry out treatment more efficiently.

With further development, the application can be integrated with existing health information systems, such as the Community Health Center Information System (SIMPUS), the Dengue Fever Surveillance system from the Health Office and the endemic zone dashboard.

Through integration, public reports will be directly entered into the official database used for regional-level monitoring and reporting. This will reduce manual administrative burdens, accelerate response times, and improve the accuracy of epidemiological data.

Integrated data from the BETAPA ANTIK app can be used as a basis for determining fogging focus areas, scheduling field visits by officers, evaluating the effectiveness of the 1 House 1 Mosquito Net Movement, and preparing monthly or annual reports by health departments. In other words, this app is part of a system that encourages real-time data-driven decision-making, rather than simply estimates or unverified manual reports.

CONCLUSION

This research successfully developed the BETAPA ANTIK application version 2.0 using the Waterfall method, which included needs analysis, system design, implementation, testing, and maintenance. This application shows significant improvements compared to the previous version, with more complete features and a more attractive appearance, including a login system to differentiate admin and public access. The GPS Camera-based location tracking feature is able to record real-time dengue case location data, effectively supporting surveillance and intervention by health workers. Reporting integration through WhatsApp and Gmail platforms facilitates coordination of case handling based on community priorities. Comprehensive educational features through videos, posters, and adult mosquito recognition cameras increase public awareness and support behavioral change in dengue prevention. Although there are still limitations such as dependence on internet connection, this application has proven to be an effective digital solution to increase the participation and efficiency of health workers in dengue control. For further development, it is recommended to add an offline mode feature and risk zone notifications for wider and optimal implementation.

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