

PAPER

Mobile Application with Artificial Intelligence Chatbots for Dengue Information and Management

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ABSTRACT

Dengue fever has intensified in recent years, affecting millions, with an estimated 100 to 400 million people yearly; approximately 80% of these cases have been reported in the Americas. This develops a prototype of a mobile application that includes artificial intelligence (AI) chatbots for dengue management and information. The design thinking methodology was applied, which was useful due to its focus on user needs, allowing the identification of key problems in dengue management and the design of innovative and functional solutions. The results were validated by experts using criteria such as technology, innovation, and feasibility with an average score of 4.26 and users using criteria such as functionality, usability, and accessibility with an average score of 4.28, showing a high level of acceptance. This tool has the potential to improve early disease detection, facilitating data collection and real-time interaction with patients. Through the use of AI, the application aims to optimize case management, reduce serious complications, and support health systems in at-risk areas.

KEYWORDS

mobile application, dengue fever, chatbot, artificial intelligence (AI)

1 INTRODUCTION

The World Health Organization Agency (WHO) notes that dengue is a viral disease transmitted by the bite of infected mosquitoes; by 2024, almost half of the world's population is at risk; it is estimated to affect between 100 and 400 million people each year [1]. According to the United Nations (UN), since the beginning of 2023, continued transmission and the unexpected increase in cases have led to a near-historic high, with more than five million infections and more than 5,000 deaths associated with dengue fever in more than 80 countries and territories; approximately 80% of these cases have been reported in the Americas [2]. In addition, [3] mentions that the increased risk of the spread of dengue is due to factors such as the expansion of mosquito vectors (*Aedes aegypti* and *Ae. Albopictus*), climate change, the effects of El Niño in 2023, the fragility of health systems in the wake of

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the COVID-19 pandemic, political and financial instability, and large population movements, and the lack of adequate surveillance in many countries has delayed the response and contributed to the increase in severe cases. Between epidemiological weeks (EP) one and 31 of 2024, the Pan American Health Organization (PAHO) reported 11,321,338 suspected cases of dengue in the Americas, representing a cumulative incidence of 1,185.51 cases per 100,000 population. This number is 234% higher compared to the same period in 2023 and 416% higher than the average of the last five years [4]. According to the Ministry of Health (MINSA) [5], groups vulnerable to dengue are pregnant women, children under the age of one, people over the age of 65, and those with pre-existing conditions such as diabetes, hypertension, or obesity, as they are at greater risk of serious complications. Contributing to the fight against this disease, the WHO highlights the transformative potential of artificial intelligence (AI) in global healthcare, which can give patients greater control over their health, improve the accuracy and speed of diagnosis, facilitate access to healthcare services in resource-poor areas and rural communities, and strengthen drug research and development [6]. As a result, studies have been carried out on the use of technology. For example, [7] describes the development of a mobile dengue alert system in Malaysia; users manually enter their body temperature and platelet level, and the app determines if they are at risk; the data is stored in the cloud and shared with hospitals to facilitate early detection and improve patient management; the system has been successfully tested on 20 patients. On the other hand, the study [8] presents “Mosquinator”, a web and mobile application that supports the Pasig Anti-Dengue Task Force (PADTF) in dengue awareness and community participation; using an agile methodology and technologies such as Flutter and MongoDB Atlas, the app allows reporting cases and monitoring risk areas; evaluated by 115 users, it obtained a rating of 4.08 according to ISO 25010 standards, highlighting its functionality, reliability, and security. In addition, [9] describes the development of the mobile application “Dengue Alert”, designed to educate and prevent dengue fever using multimedia components such as text, images, and animation, which was developed with the method of certainty factors to support decision making, this allows users to identify the symptoms of dengue and get treatment recommendations; using the waterfall model of the software development life cycle (SDLC), the results showed that the application has an accuracy of 97.6% in the prediction of Dengue Hemorrhagic Fever, facilitating its early detection. Finally, in the research [10], a prototype application to improve the follow-up and management of tuberculosis patients was presented; this tool facilitates real-time interaction with doctors, provides access to medical records, and sends medication reminders; the development was based on the mobile D methodology, resulting in scores of 4.77 for effectiveness and 4.69 for usability, confirming its high quality.

Therefore, this study aims to design mobile AI chatbots for dengue management and informatics, evaluating how this tool can improve early detection of the disease, facilitate case monitoring, and increase community awareness. In addition, it aims to examine the effectiveness of the prototype in providing accurate information and promoting preventive practices.

2 METHODOLOGY

The design thinking methodology has become a key tool for companies, as it is oriented towards people-centered innovation, offering a perspective that makes it easier to identify challenges, detect needs, and solve them. [11]. It also focuses on understanding customer challenges and identifying their main needs, wants, and concerns; this methodology involves observing user behavior to generate

continuous improvements, adopting a collaborative approach that tests effective design practices, and has five stages: empathize, define, ideate, prototype, and evaluate [12], [13]. Figure 1 shows the above steps.

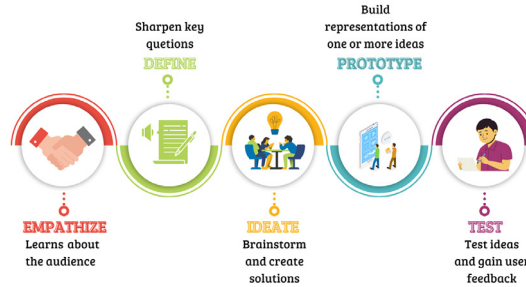


Fig. 1. Phases of the design thinking methodology

2.1 Empathize

The first phase of the design thinking methodology starts with research focused on the needs of the user or consumer. [14]. To develop a solution, it is essential to put ourselves in the shoes of the people whose problems we are trying to solve. Users of the mobile application for dengue information and management have specific needs that require careful attention. They are looking for a safe and confidential environment where they can express their health concerns without fear of judgment. It is essential that they feel that their concerns are understood and validated. The application should offer personalized support through AI chatbots, able to actively listen and empathize with queries. This emotional support is key for users to feel accompanied during the monitoring and prevention process, providing them with motivation and reassurance. In addition, they may require clear guidance, medical advice, and practical strategies to manage their health and prevent infection. To gain a better understanding of these needs, interviews with clients were conducted along four main dimensions, as visualized in Table 1.

Table 1. Questions focused on user needs

Dimensions	Questions
Interaction	What kind of interaction do you expect to get from the chatbot about dengue prevention and management?
	What information or support would you like the chatbot to provide you with about dengue?
	Are you concerned about confidentiality and privacy when interacting with the chatbot about health issues?
Content	Would you like the chatbot to include recommendations for prevention, treatment, and healthy habits related to dengue? If yes, why?
	What kind of information do you find most useful to stay informed about dengue (symptoms, treatment, risk areas, etc.)?
Accessibility	Do you find it useful to make the chatbot available on multiple devices, such as phones, tablets, or computers, to ensure access from different environments?
Expectations	Do you think an artificial intelligence chatbot could be an effective solution to obtain information and manage your concerns about dengue, or do you see it more as a complementary tool?

Figure 3 shows the results of the analysis conducted in ATLAS.ti 24, showing that respondents have a positive perception of the interaction with a mobile application for dengue management, as long as the chatbot is innovative, easy to use, and offers quick and accurate answers. In terms of content, interviewees recognize that they are aware of the serious consequences of dengue but point out that there is a lack of public information about side effects and ways of prevention. Regarding accessibility, participants highlighted the importance of being able to access the chatbot from different

platforms and devices, prioritizing ease of use in areas with poor connectivity. Finally, about expectations, interviewees considered that the chatbot should provide clear and reliable information, similar to the experience one would have when interacting with a medical professional. As a result of the qualitative analysis conducted with ATLAS.ti 24, it is concluded that a well-designed mobile application could become a fundamental tool to improve dengue awareness and management effectively and safely.

2.2 Define

This is the second stage in which the information collected during the empathy phase is organized and processed; its objective is to synthesize the data to discover key findings to formulate the design problem. [15]. Stakeholders can point out an evolution from the current situation to a future one.

The software to be used in the application will then be defined.

Software

- **Wasapi** – It is an advanced platform based on the WhatsApp Business API that offers AI, complex automation, and integrations with other systems to improve large-scale business communication [16].
- **Chatgpt** – It is an AI-based language model designed to generate coherent and relevant text based on user input [17].
- **Python** – It is a versatile programming language that facilitates rapid development and efficient system integration [18].
- **Meta** – It is a global technology company focused on building social media platforms and immersive experiences, driving innovations in AI and virtual reality [19].
- **Heroku** – It is a cloud platform that simplifies the development, deployment, and scaling of web applications, offering a managed environment for a variety of programming languages [20].

Figure 2 shows the architecture where a user interacts with a mobile application, which connects to a Heroku backend developed in Python. The backend communicates with several external services, such as Meta API for notifications or authentication, Wasapi for Windows audio processing, and ChatGPT to integrate an AI chatbot. The data flow goes from the user to the backend through the application, with the backend managing the connections to these services to process and respond to user requests.

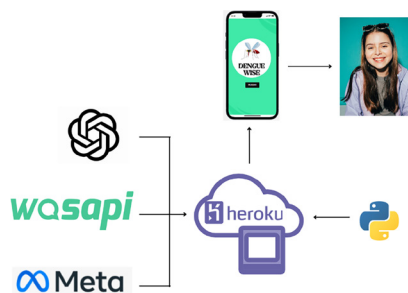


Fig. 2. Project architecture

2.3 Ideate

Moving to the third phase, we begin to develop solutions to the specific problems identified, i.e., that address the user's needs and desires [21].

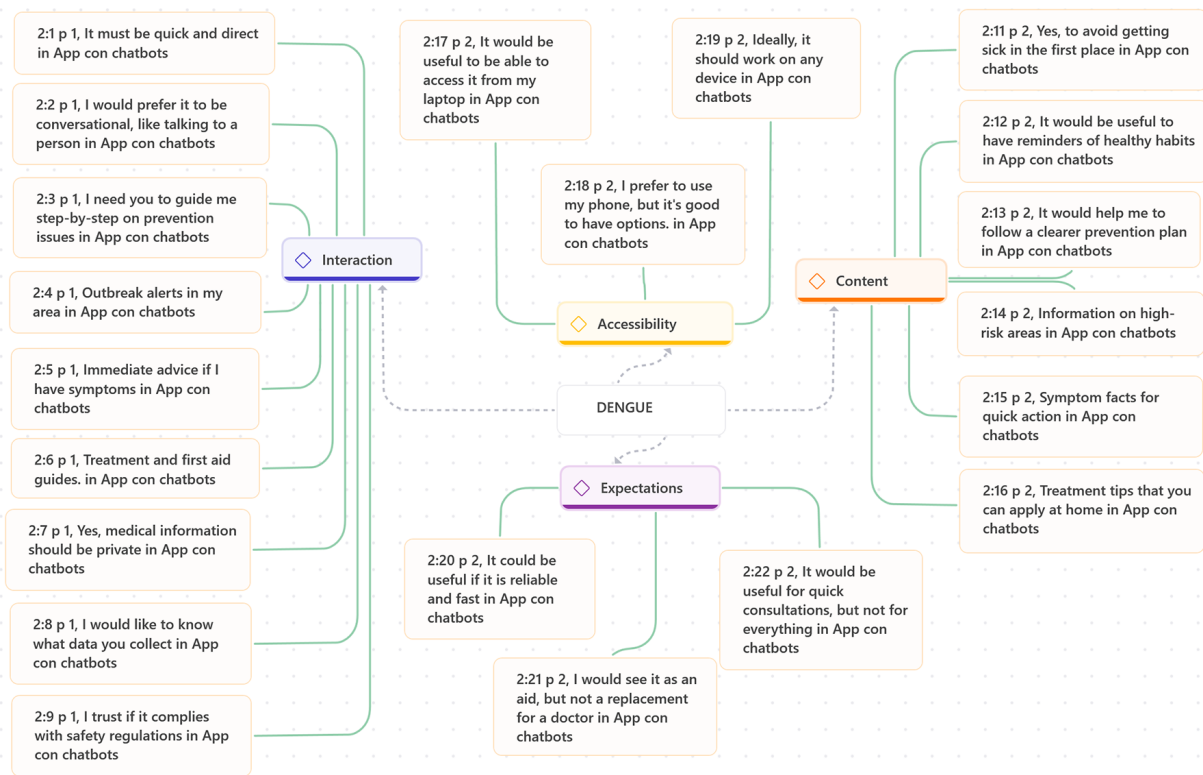


Fig. 3. Analysis of the interview

2.4 Prototype

A prototype is a tangible representation of ideas generated in earlier phases, created for testing, improvement, and feedback; it is a key tool for experimenting and visualizing solutions. [22]. Figure 4 presents the prototypes of the registration, login, and profile editing interface. Users are required to fill in all the necessary data to access the application, which is targeted at people seeking information or suffering from dengue. Figure 4a offers the option to register using a Gmail or Facebook account. Finally, Figure 4b shows the profile of the logged-in user with the option to edit their data.

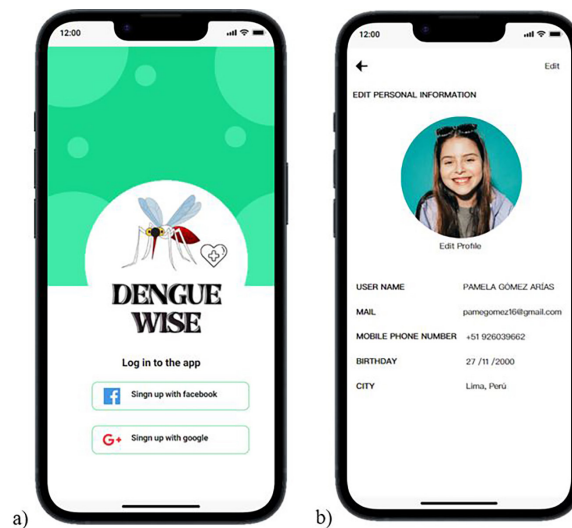


Fig. 4. Mobile application for dengue: (a) Login screen, (b) Profile

Figure 5 presents the main menu interface, where the user can access various functionalities, such as outbreak alerts, personal medical history, preventive education, and updated epidemiological data on the dengue situation. Figure 5a shows the menu screen along with the chatbot icon, which allows the user to interact and resolve any questions. Figure 5b highlights the detailed visualization of the epidemiological data on dengue, providing up-to-date information to keep the user effectively informed.

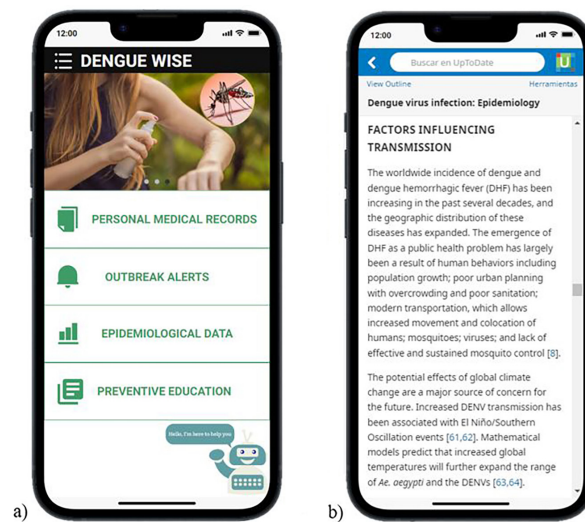


Fig. 5. Main menu interface: (a) Menu screen with access to the chatbot, (b) Viewing epidemiological data

Figure 6 presents the interactive chat between the user and the chatbot, where friendly communication is evident, including graphics, locations, and up-to-date data on dengue. In Figure 6a, the chatbot provides information on dengue symptoms; in Figure 6b, the location of the nearest health centers is shown; and in Figure 6c, current data on dengue cases in the city and the most affected districts are presented through detailed graphics.

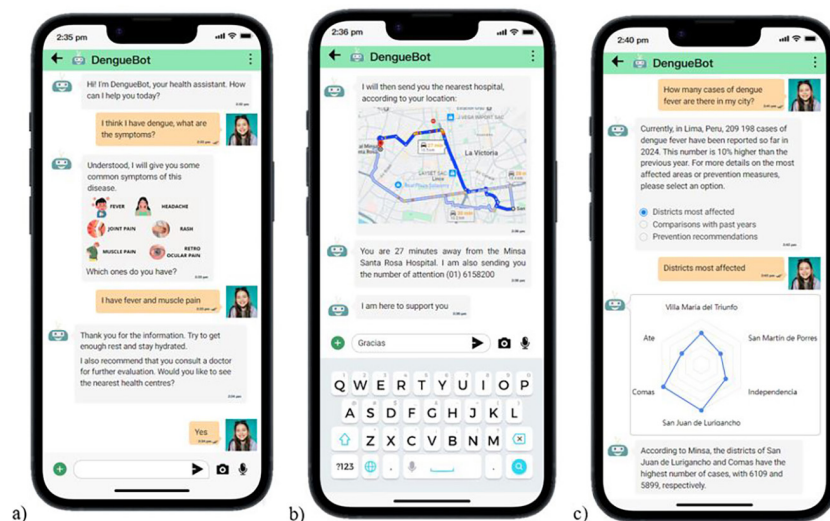


Fig. 6. User chat interfaces with the chatbot: (a) Dengue symptoms, (b) Information on the location of the nearest health centers, (c) Graphs of updated data on dengue cases

2.5 Test

Validating involves presenting the prototype to the user and listening empathically to their feedback, leaving aside our ideas; based on this feedback, strategic decisions are made to adjust the solution to the user’s needs. [23]. Table 2 shows questions based on criteria such as technology, innovation, and feasibility for specialists to evaluate and make a decision showing their approval.

Table 2. Satisfaction questionnaire for specialists

Criteria	Questions
Technology	How well is the chatbot optimized to work on a variety of devices and operating systems (iOS, Android, etc.)?
	How compatible is the chatbot with assistive technologies, such as screen readers or accessibility tools, according to technology standards?
	How effective is the chatbot in providing real-time updates and notifications on the dengue situation?
Innovation	How innovative do you consider the use of artificial intelligence technologies in the dengue management application?
	How unique do you find the chatbot’s features compared to other disease management systems?
	How well is the application integrated with new functionalities or innovative approaches to address the dengue problem?
Feasibility	Is the application able to function effectively with the technological infrastructure available in dengue-affected areas?
	Are there sufficient resources to maintain and update the application in the long term?
	Is the business model of the application sustainable and adapted to the needs and capacities of the target market?

Table 3 shows the questions for users through criteria such as functionality, usability, and accessibility.

Table 3. Satisfaction questionnaire for users

Criteria	Questions
Functionality	Is the chatbot able to provide accurate and up-to-date information on dengue in real time?
	Does the application allow users to manage and track dengue cases efficiently?
	Does the application allow for specific actions, such as sending alerts or notifications, related to dengue management?
Usability	Is the application’s interface intuitive?
	Does the chatbot provide clear and understandable answers to users?
	Is any form of assistance or tutorial offered to help users become familiar with the application’s functions?
Accessibility	How necessary do you think it will be to access the chatbot in areas with limited connectivity or no internet access?
	Do you consider it important that the chatbot is available in your local language or dialect?
	How easy is it for you to access the application from different devices (smartphones, tablets, etc.)?

3 RESULTS

The evaluation of the prototype of the mobile application was carried out through the judgments of experts and the users themselves. The results were presented in a clear and transparent way, and this will help to determine the possibility of the application and to gain part of the amount needed to implement the application for profit.

3.1 Validation by specialists

The validation of the application was carried out with the participation of 10 experts, who evaluated the system according to the criteria of technology, innovation, and feasibility. The evaluations were carried out using a Likert scale, resulting in a final score of 4.26, which indicates a very high quality of the application.

Table 4. Evaluation of specialist satisfaction

Criteria	Questions	Average	SD
Technology	How well is the chatbot optimized to work on a variety of devices and operating systems (iOS, Android, etc.)?	4.40	0.84
	How compatible is the chatbot with assistive technologies, such as screen readers or accessibility tools, according to technology standards?	4.30	0.67
	How effective is the chatbot in providing real-time updates and notifications on the dengue situation?	4.40	0.70
Innovation	How innovative do you consider the use of artificial intelligence technologies in the dengue management application?	4.40	0.52
	How unique do you find the chatbot's features compared to other disease management systems?	4.10	0.57
	How well is the application integrated with new functionalities or innovative approaches to address the dengue problem?	4.40	0.84
Feasibility	Is the application able to function effectively with the technological infrastructure available in dengue-affected areas?	4.50	0.71
	Are there sufficient resources to maintain and update the application in the long term?	3.90	0.32
	Is the business model of the application sustainable and adapted to the needs and capacities of the target market?	3.90	0.57
Total		4.26	0.64

Figure 7 presents the results of the criteria evaluation carried out by the specialists. When evaluated on a Likert scale, it is highlighted that 90% of them consider the innovation of the application to be “Good” and “Very Good”. In addition, the technology criterion scores 86.7%, while the application’s flexibility scores 86.7% in the “Good” and “Very Good” categories. These results lead to the conclusion that the application has been favorably approved.

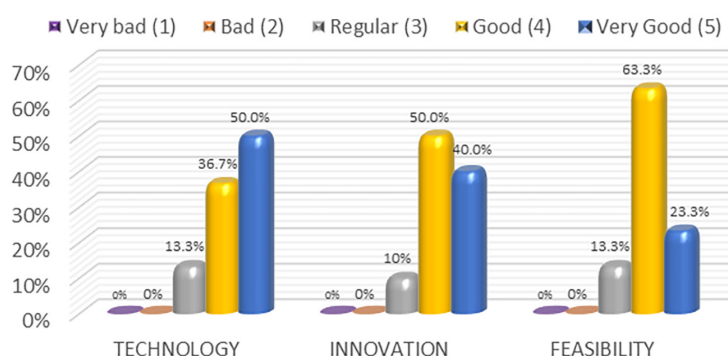


Fig. 7. Specialist evaluation results

3.2 Validation by user

Validation was carried out by 20 users, and the answers obtained are shown in Table 5.

Table 5. User satisfaction evaluation

Criteria	Questions	Average	SD
Functionality	Is the chatbot able to provide accurate and up-to-date information on dengue in real time?	4.25	0.85
	Does the application allow users to manage and track dengue cases efficiently?	4.30	0.92
	Does the application allow for specific actions, such as sending alerts or notifications, related to dengue management?	4.45	0.89
Usability	Is the application’s interface intuitive?	4.20	1.01
	Does the chatbot provide clear and understandable answers to users?	4.20	1.01
	Is any form of assistance or tutorial offered to help users familiarize themselves with the functions of the application?	4.40	0.82
Accessibility	How necessary do you think it will be to access the chatbot in areas with limited connectivity or no internet access?	4.30	0.80
	Do you consider it important that the chatbot is available in your local language or dialect?	4.25	0.97
	How easy is it for you to access the application from different devices (smartphones, tablets, etc)?	4.20	0.83
Total		4.28	0.99

Figure 8 shows that usability is the highest rated criterion with 60% in the very good category. In addition, functionality scores 58.3%, while accessibility follows with 51.7% in the same rating. This visual representation allows a quick understanding of the strengths and areas for improvement of the prototype in each of the evaluated criteria.

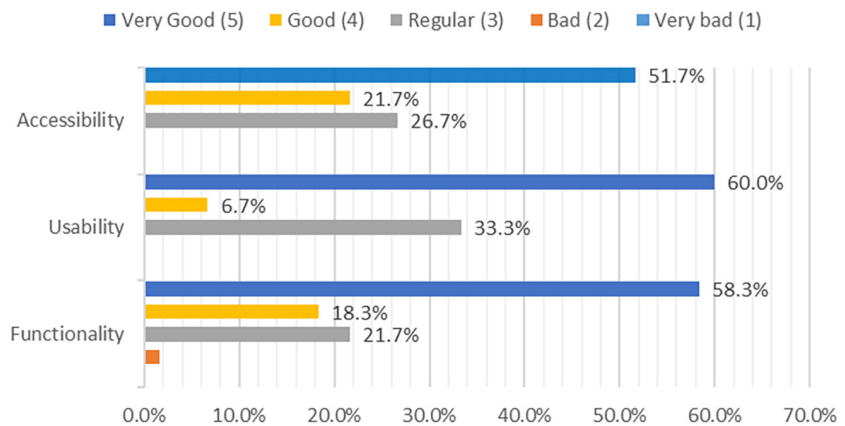


Fig. 8. Summary of criteria

4 DISCUSSION

The mobile application with integrated AI chatbots for dengue management and information was realized using the design thinking methodology, which has been very helpful due to its user-centered approach. Compared to [9] used the certainty factors’ method to develop a mobile application to educate and prevent dengue fever, using the cascade model of the SDLC, obtaining an accuracy of 97.6% in the prediction of Dengue Haemorrhagic Fever, facilitating its early detection. On the other hand, [7] Developed a mobile application to alert about dengue in Malaysia, users manually enter their body temperature and platelet level, and the application

determines if they are at risk; it has been successfully approved in 20 patients. In turn, the study [8] presented “Mosquinator,” a web and mobile application that supports dengue awareness and community participation, using an agile methodology and technologies such as Flutter and MongoDB Atlas, allowing users to report cases and monitor risk areas. When evaluated by 115 users, it obtained a score of 4.08 according to ISO 25010 standards, standing out for its functionality, reliability, and security. The present research [24] describes the development of a mobile medical assistant using a chatbot and an analytical system to help patients with dengue fever, the development incorporates technologies such as natural language processing, artificial neural networks (ANN), machine learning, image processing, convolutional neural networks (CNN) and Android. The results demonstrate a high efficiency in the analysis of dengue conditions. Unlike previous studies in the field of chatbots and mental health, the present research introduces notable differences and provides specific contributions.

5 CONCLUSION

According to the experts’ evaluation, the mobile application was designed optimally, fulfilling all the established criteria. The results of the user survey reflect a high degree of satisfaction with the application, highlighting aspects such as functionality, use, and accessibility, which showed a high level of acceptance. The design thinking methodology was used, which allowed the development of a solution focused on the user’s needs. A limitation of this study was the lack of access to more extensive or diversified data. For future research, it is suggested to include a larger sample of users and evaluate the long-term impact. It is also recommended to implement the design as a pilot test to obtain more specific feedback. The use of other emerging technologies will contribute to solving health problems such as infectious disease management and improving the effectiveness and accessibility of digital solutions.

6 REFERENCES

- [1] World Health Organization (WHO), “Dengue y dengue grave,” 2024. [Online]. Available: <https://www.who.int/es/news-room/fact-sheets/detail/dengue-and-severe-dengue> [Accessed: May 07, 2024].
- [2] United Nations, “El aumento de los casos de dengue es ‘una grave amenaza’, alerta la OMS,” 2923. [Online]. Available: <https://news.un.org/es/story/2023/12/1526702> [Accessed: Sep. 05, 2024].
- [3] World Health Organization (WHO), “Dengue – Situación mundial,” 2023. [Online]. Available: <https://www.who.int/es/emergencias/disease-outbreak-news/item/2023-DON498> [Accessed: May 07, 2024].
- [4] Organización Panamericana de la Salud (OPS), “Situación epidemiológica del dengue,” OPS/OMS, 2024. [Online]. Available: <https://www.paho.org/es/arbo-portal/dengue/situacion-epidemiologica-dengue> [Accessed: Sep. 05, 2024].
- [5] “¿Qué es el dengue?” - Orientación - Ministerio de Salud - Plataforma del Estado Peruano.” Accessed: May 07, 2024. [Online]. Available: <https://www.gob.pe/21593-que-es-el-dengue>
- [6] World Health Organization (WHO), “La OMS publica el primer informe mundial sobre inteligencia artificial (IA) aplicada a la salud y seis principios rectores relativos a su concepción y utilización,” 2021. [Online]. Available: <https://www.who.int/es/news/item/28-06-2021-who-issues-first-global-report-on-ai-in-health-and-six-guiding-principles-for-its-design-and-use> [Accessed: Sep. 05, 2024].

- [7] M. Kassim, N. A. N. Ali, A. Idris, S. Shahbudin, and R. A. Rahman, "Dengue attack analysis system on mobile application," in *Proceedings 2018 IEEE 8th International Conference on System Engineering and Technology (ICSET)*, 2018, pp. 151–156. <https://doi.org/10.1109/ICSEngT.2018.8606397>
- [8] R. J. C. Cruz, R. V. A. S. Juan, R. C. S. Cristobal, L. A. D. Lo, and L. B. Valdez, "Mosquinator: A community-based mobile and web application framework for combating dengue and providing awareness for residents of Pasig City," in *Proceedings 2024 7th International Conference on Information and Computer Technologies (ICICT)*, 2024, pp. 326–331. <https://doi.org/10.1109/ICICT62343.2024.00059>
- [9] A. Khozaimi, "Mobile expert system for dengue fever based on certainty factor method," *J. Phys. Conf. Ser.*, 2020, vol. 1569, no. 2, p. 022070. <https://doi.org/10.1088/1742-6596/1569/2/022070>
- [10] M. Cabanillas-Carbonell, "Mobile application to improve the follow-up and control process in patients with tuberculosis," *International Journal of Interactive Mobile Technologies (IJIM)*, vol. 18, no. 3, pp. 75–87, 2024. <https://doi.org/10.3991/ijim.v18i03.46875>
- [11] "La metodología design thinking: definición y fases - Fundación Aquae." Accessed: Sep. 11, 2024. [Online]. Available: <https://www.fundacionaquae.org/wiki/que-es-el-design-thinking/>
- [12] E. Knight, J. Daymond, and S. Paroutis, "Design-led strategy: How to bring design thinking into the art of strategic management," *California Management Review*, vol. 62, no. 2, pp. 30–52, 2020. <https://doi.org/10.1177/0008125619897594>
- [13] C. Dell'Era, S. Magistretti, C. Cautela, R. Verganti, and F. Zurlo, "Four kinds of design thinking: From ideating to making, engaging, and criticizing," *Creativity and Innovation Management*, vol. 29, no. 2, pp. 324–344, 2020. <https://doi.org/10.1111/caim.12353>
- [14] "La metodología design thinking: definición y fases - Fundación Aquae." Accessed: Sep. 12, 2024. [Online]. Available: <https://www.fundacionaquae.org/wiki/que-es-el-design-thinking/>
- [15] "Definir, segunda de las etapas en todo proceso de Design Thinking." Accessed: Sep. 12, 2024. [Online]. Available: <https://xn--designthinkingespaa-d4b.com/definir-segunda-etapas-design-thinking>
- [16] "Wasapi | Gestiona, Vende y Automatiza en WhatsApp con IA." Accessed: Sep. 17, 2024. [Online]. Available: <https://www.wasapi.io/>
- [17] OpenAI, "ChatGPT." [Online]. Available: <https://openai.com/chatgpt/> [Accessed: Sep. 17, 2024].
- [18] Python, "Welcome to Python.org." [Online]. Available: <https://www.python.org/> [Accessed: Sep. 17, 2024].
- [19] Facebook, "Meta for Developers." [Online]. Available: <https://developers.facebook.com/> [Accessed: Sep. 17, 2024].
- [20] Heroku, "Cloud Application Platform | Heroku." [Online]. Available: <https://www.heroku.com/> [Accessed: Sep. 17, 2024].
- [21] Design Thinking, "La fase Idear dentro de un proceso de Design Thinking," 2024. [Online]. Available: <https://xn--designthinkingespaa-d4b.com/idear-tercera-fase-design-thinking> [Accessed: Sep. 12, 2024].
- [22] Design Thinking, "Prototipar," 2024. [Online]. Available: <https://xn--designthinkingespaa-d4b.com/prototipar> [Accessed: Sep. 12, 2024].
- [23] Design Thinking, "Validar," 2024. [Online]. Available: <https://xn--designthinkingespaa-d4b.com/validar-ultima-etapa-design-thinking> [Accessed: Sep. 12, 2024].
- [24] K. T. K. Jayampathi, M. A. C. Jananjaya, E. P. C. Fernando, Y. A. Liyanage, M. G. N. M. Pemadasa, and G. W. D. A. Gunarathne, "Mobile medical assistant and analytical system for dengue patients," in *Proceedings 3rd International Conference on Advancements in Computing (ICAC)*, 2021, pp. 371–376. <https://doi.org/10.1109/ICAC54203.2021.9671097>

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