Mobile based chatbot application for HIV/AIDS counseling using artificial intelligence markup language approach

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Abstract. Acquired Immune Deficiency Syndrome (AIDS) is a fearsome epidemic for modern society as the virus itself shortening the human life expectancy. Based on the report issued by the National committee of sexually transmitted diseases monitoring agency. In the 3rd quarter of 2017, Bali is the 4th most province with major HIV infection in the country. One of the foundations that focuses on HIV/AIDS assistance and prevention in Bali is Spirit Paramacitta Foundation. The problems faced by the Foundation are the limitations of the counselor and the reluctance of the community to consult. With the advancement of the information technologies and to support the goodwill of foundation is the basis of why this research exists. The goal of this research is to build a mobile-based chatbot application using Artificial Intelligence Markup Language (AIML), that will aid the foundation in giving people a reliable HIV/AIDS related information. AIML is used because it can make bots close to human capabilities. The application would be able to emulate the human conversation as good as the usual counseling session. The result of this research is chatbot has been able to help Spirit Paramacitta Foundation in counseling and disseminate information related to HIV/AIDS to the community.

1. Introduction

Human immunodeficiency virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) has posed a serious threat throughout the world since its discovery in 1981 [1]. Acquired Immunodeficiency Syndrome caused by Human immunodeficiency virus is global pandemic and became greatest public health concern in recent time [2]. AIDS is a collective symptom as to diminishing ability to survive because of the infection of HIV in human body [3]. After entering the human body, HIV attacks certain cells of the immune system and destroys them [4]. Human body with advanced HIV are vulnerable to opportunistic infections because a weakened immune system [5]. An opportunistic infections as cause of death in HIV infection of human body.

Based on the progress report of HIV / AIDS & sexually transmitted diseases from Indonesian Health Ministry in the first quarter of 2017, Bali province was ranked 4th in the number of most AIDS sufferers with 6824 cases. To prevent an increase in the number of HIV / AIDS sufferers, the government and the community have made various efforts. One of the foundations that provide assistance to people living with HIV / AIDS (PLHWA) in Bali is the Spirit Paramacitta Foundation. The foundation was established in 2001 and has a focus on the HIV / AIDS prevention movement in Bali. Paramacitta Spirit Foundation also empowered PLHWA to carry out activities as part of the community. Spirit Paramacitta Foundation provides assistance to PLHWA in all districts in Bali. One of the mentoring programs in Spirit Paramacitta Foundation is counseling. Counseling has a role in preventing HIV / AIDS transmission.
Through counseling, counselors can help improve the quality of life of PLWHA. The problems found during counseling are the reluctance of the community to consult with counselors or seek information regarding HIV / AIDS. This reluctance arises because of fear and ignorance that makes someone close himself to HIV / AIDS information. The negative stigma that still exists in the community when someone meets a counselor also strengthens a person's reluctance to counsel.

Along with the development of technology and the desire of Spirit Paramacitta Foundation to provide information and counseling for the community related to HIV / AIDS using technology, this study aims to build the CHATBOT application for HIV / AIDS counseling. Chatbot or Chatterbots or chatter robots are software agents that simulate an entity that can interact in a conversation [6]. Chatbot can be considered as a question-answer system that can provide knowledge provided by experts according to user requests [7]. Chatbot technology is not new thing, it's started when Joseph Weizenbaum’s program ELIZA published in 1966 [8]. Eliza used pattern matching and substitution methodologies to simulate conversation. The key method of operation on ELIZA involves the recognition of cue words or phrases in the input and the output of corresponding pre-prepared or pre-programmed responses that can move the conversation forward in an apparently meaningful way [9].

This research used chatbot as a question-answer system that can provide information regarding HIV / AIDS to the general public or PLWHA. Chatbot answers like a counselor to questions from users. The knowledge base used in the CHATBOT application is built using the artificial intelligence markup language (AIML). Reason for choosing AIML because it is efficient and lightweight in use [10]. Chatbot application is made based on the Android mobile operating system because it is widely used by Indonesians. Market share of the Android mobile operating system in Indonesia reaches 91.16% [11].

2. Methodology
This research develops android-based chatbot application for HIV / AIDS counseling using 4 phases of development, which are 1) user requirements; 2) system design; 3) system development; 4) system evaluation.

2.1. User requirements
This phase is used to find out user needs. This phase begins by collecting data through interviews and literature. In the interview process, data was collected by interviewing counselors at Spirit Parramatta foundation. Information collected in this process is a question that often asked during counseling sessions and user characteristics. To support information related to HIV / AIDS used data collection through literature related to HIV / AIDS. Data that has been collected is then analyzed to determine user needs.

2.2. System design
After going through the phase of user requirements. The results of the analysis generated by the user requirements are used as a basis for system design. Some things that are considered in designing the system, which are 1) Selection of the base of the mobile operating system to be used. Android mobile operating system was preferred because it is widely used by target users; 2) the application used to develop Chatbot applications is Android Studio with JAVA programming language. Android Studio was chosen because it's recommended for developing applications based on the Android mobile operating system. 3) Chatbot application design is made simple. So the user doesn't feel complicated when using it. Figure 1 show Use Case Diagram of Chatbot Application.
Chatbot application display is made simple like a chat application that is used by users. The reason is to make users feel familiar with the chatbot application. Figure 2 show mockup of chatbot application.

Chatbot Application allows users to ask questions and gives respond according to the topic the user asked. Chatbot. Application uses a pattern matching algorithm to match user questions with answers. AIML interpreter is responsible for matching questions with a knowledge base pattern and responding according to the template. Figure 3 show Chatbot structure.
AIML interpreters use pattern matching algorithms. AIML Interpreters try to match word for word to get the longest pattern matching. If a match is found in the <pattern> tag, the value corresponding to the <template> tag is returned as a response to the user's question. The following example show a simple atomic AIML category.

```
<category>
    <pattern> HELLO </pattern>
    <template>
        Hello This Is Bot Response
    </template>
</category>
```

2.3. System development
The results of the system design phase are realized into an Android-based chatbot application at this stage. This stage changes the design to the program code. Chatbot application was built using Android Studio, using Java language programming. After successfully being realized in the form of program code. The application then passes the Black-box testing test process to determine the application functionality as planned.

Some of thing to consider in this test which are 1) The linkage of the topic between entering a user's word or sentence with the response of the word or sentence given by the chatbot, 2) A response of words or sentences given by chatbot if the desired information is not found in the chatbot knowledge base. 3) A response of words or sentences given if information input is not related to questions about HIV / AIDS.

Chatbot application is also tried in several Android devices to find out whether it can run on a different Android device. The minimal version of the Android operating system supported by the chatbot application is 4.4 KitKat.
2.4. System evaluation
In system evaluation phase, usability and accuracy of chatbot application are tested. The usability testing is used to know the level of satisfaction of user that using the application. Accuracy testing is used to know accuracy answer of chatbot response according to question that user asked.

3. Results and discussion
To assess the performance of the chatbot system that was developed, it was tested with usability testing and accuracy testing. Usability testing is used to determine user satisfaction with the interface and ease of use of the chatbot application that has been developed. Usability testing was carried out for 30 people randomly to use the chatbot application. Usability testing was done by giving a number of tasks to users to interact with the system. After the user has done all the tasks, the user then answers the questionnaire prepared based on experience while working on tasks that have been carried out with a range of 1.00 to 4.00. Every question contained in usability testing has represented every aspect described by Nielsen's Approach namely learnability, efficiency, memorability, errors and satisfaction. Figure 4 is the result of usability testing.

![Usability Testing](image)

**Figure 4.** Result of usability testing.

Based on usability testing, the average value of usability testing is 3.30 from a maximum value of 4.00. These results prove, the user has been satisfied with the application offered is in satisfactory condition. In usability testing, Learnability has a value of 3.60 which means that the chatbot application is easy to use by the user. Efficiency has a value of 3.00 which means that this application is able to facilitate the counseling process about HIV/AIDS. Memorability has a value of 3.50, meaning that users can easily operate the application again after a long time not using the application. Errors have a low value because the chatbot application needs more databases to improve the accuracy of the answers expected by the user. Satisfaction has a test result of 3.60 meaning that the user is satisfied with the interface design and function of the chatbot application that was developed.

To test the accuracy of the chatbot system, the accuracy of the results of the system answers is then tested. In the test of accuracy system, will be used 30 random user samples to use the chatbot application and interact with the system. Questions given by users must be related to HIV/AIDS and counseling. Figure 5 is the result of accuracy testing conducted by 30 people randomly.
Figure 5. Result of accuracy testing (30 user).

Based on the results of accuracy testing, from 10 questions submitted by the user to the chatbot system, the highest true answer can be answered by the system is 9 answers. This proves that the system is reliable enough to handle counseling with formal questions related to introduction and HIV/AIDS. Overall, the correct answers that can be answered by the system are 9 answers and the lowest correct answers that are answered by the system are 5 answers.

Figure 6. Result of accuracy testing.

When viewed globally, the results of accuracy testing on the Mobile Based Chatbot Application for HIV/AIDS Counseling Using Artificial Intelligence Markup Language Approach application have been able to reach 71%. This proves that the chatbot application for HIV / AID counseling developed is sufficient enough to assist the HIV/AIDS counseling process at the Paramacitta Spirit Foundation. System errors in answering questions given by the user are caused by a lack of knowledge database embedded in the system. The more questions the system gives and the answers given by the system are wrong. Then the wrong answer will be a report for the admin to continue to add knowledge database from the chatbot system so that the chatbot system will be smarter and the testing accuracy value will increase.
4. Conclusion
The results of this study are the Mobile Based Chatbot Application for HIV/AIDS Counseling Using Artificial Intelligence Markup Language Approach has been able to help users to conduct counseling related to HIV / AID. The average value of usability testing is 3.30 from a maximum value of 4.00. These results prove that the user is satisfied with the chatbot application offered. Then based on the value of accuracy testing, the accuracy of the correct answers given by the chatbot system is 71%. The incorrect answer on the accuracy testing because of the lack of knowledge databases in the system. The more training provided to the system and more database knowledge will increase the accuracy system.

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