Design of Learning Application using Trivia Method based on Google Assistant for Vision Impairment Disability

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Abstract— This mobile based application called Natasha Bot is a virtual learning media aimed at people with disabilities especially blind people. Natasha Bot contains questions about subjects in schools designed for elementary school students in grade 6 in the form of guessing or trivia. The system and infrastructure supporting learning activities for people with disabilities that have been facilitated by the government are still lacking. Some problems have arisen such as the inconvenience of students with disabilities in the learning environment because they feel different. Teachers in inclusive schools also have not been equipped with special skills or techniques for people with disabilities. The Natasha Bot application comes as an innovation that utilizes open source technology from Google. It is designed to make students with disabilities, especially the blind, feel comfortable in learning activities. Natasha Bot offers voice features as a two-way communication between the student and Bot. This research uses the design thinking method. To create Natasha Bot as a virtual friend as well as a learning media. Natasha Bot comes with Artificial Intelligence technology and is designed using the Google Assistant framework with the method of trivia or guessing. Natasha Bot is expected to help advance the world of education, especially for people with disabilities on visual impairments with a more teachable and psychological approach.

Keywords— virtual learning, disability, blindness, Google Assistant, artificial intelligence

I. INTRODUCTION

Persons with disabilities can be defined as individuals who have limitations in their activities both physically and mentally which can be an illness from birth or due to an accident. There are 15% of people with disabilities in the world according to statistics from the International Health Organization (WHO) [1]. In addition, there are 21.84 million people with disabilities in Indonesia or equivalent to 8.56 percent of the total population according to the Inter-Census Population Survey (SUPAS) in 2015. The 2015 SUPAS survey also found that the total percentage of people with visual impairments is 29.63%, ranked the second highest among other disabilities.

Many stereotypes of Indonesian society still underestimate and think that people with disabilities cannot do something like most people. Therefore, they are often treated unfairly. In fact, there are many people with disabilities who still excel and have jobs.

One of the rights of persons with disabilities to have equal access to education has been stated in Indonesian Law Number 19 year 2011 concerning the rights of persons with disabilities. However, there are still problems regarding the fulfillment of the right to education and the learning system in schools for persons with disabilities, even though legally it is clearly written. The government has also provided inclusive schools with the hope that people with disabilities can adapt to the school environment in general but in fact, not all persons with disabilities can adapt well to inclusive schools, the infrastructure is inadequate, many teachers are not equipped to teach people with disabilities, as well as people with disabilities. with disabilities who feel ashamed because their classmates make fun of them [2]. This shows that the solutions made by the government in an effort to fulfill the right to access to proper education have not been able to touch the technical and psychological aspects of persons with disabilities.

The user-centered-design approach can be done to solve these problems where the use of digital technology application interfaces as learning media is able to touch technical, accessibility and psychological sides [3]. However, to meet the three criteria above, the technology seems difficult. The technology for learning media that currently exists is only in the form of video, audio, and websites, which means that there is no digital technology or product that leads to a psychological approach. A more intuitive and futuristic approach is needed to create this kind of application where the application is able to make someone feel like they have a study partner who makes them comfortable and excited to learn.

Based on the above problems, this study aims to build an AI technology (artificial intelligence) that researchers designed by making a virtual learning partner based on Google Assistant. Previous study show the implementation of Google Assistant technology in language education [4]. Google Assistant technology offers teachers or language instructors an alternative methods of teaching in comparison to the normally practiced ones. The application developed in this research will then be called "Natasha Bot" which functions as a learning partner as well as a learning

medium for people with visual impairments. The concept used in the first development prototype is based on the trivia method which contains a sample of several subjects in elementary schools.

II. THEORIES

A. Google Assistant

Google Assistant is a product from Google, an "assistant" in virtual form, which users can use with two-way communication. The two-way communication provided by Google Assistant has a voice feature that makes it easier for users to access the applications they need.

B. Design Thinking

Design Thinking is an analytical method that underlies the manufacture of a product by matching people's needs with what is technologically feasible and feasible according to a business plan that has a high chance of being converted into customer value and market opportunities [5].

C. Black Box Testing

Blackbox testing can be called behavioral or functional testing which focuses on the functional requirements of the software. This blackbox testing technique allows researchers to obtain a series of conditions that are fully incorporated into a program to carry out all functional requirements of the program. By using this blackbox testing technique, researchers can find out whether there is an error or not from a series of conditions that have been made in the form of a task or testing scenario that tests program functions [6].

D. Usability Testing

Usability testing is a method for testing a product directly on prospective users with the aim of evaluating the product before it is officially issued. Prior to testing, a scenario will be provided to the user. When testing takes place, the user tries the application with a given scenario, then the researcher will record and observe in detail every response from the user. Usability testing aims to see user satisfaction and look for problems or weaknesses in the application with the qualitative and quantitative data that has been collected [7].

III. METHODS

This research implements design thinking method. The basis for the design thinking method is empathy, being sensitive to the problems that exist around it then thinking about a solution by designing a solution model where the design will be tested for implementation. The design thinking method is considered appropriate to produce the latest innovations that can meet the actual needs of users, in other words, to make products right on target [8]. The overall flow of this research is presented in Figure 1.

A. Data Collection

At the data collection stage, the researcher looks for sources of data and information related to research. Activities carried out include seeking information from books, journals, and previous research that examines things that are similar to this research, namely applications as

learning media for people with disabilities. Several selected books and journals are used as bibliography in this study. In the design thinking method, the data collection stage enters the "empathize" stage.
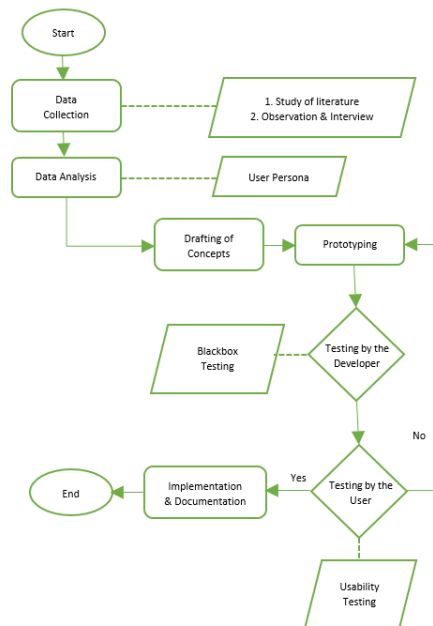

Fig. 1. Flow of the research

B. Data Analysis

After the data collection stage, the information and data that has been collected are analyzed to determine the core problems that will be identified and to think of ideas for the right solutions to these problems in the form of the latest functions and features in experimental applications. Data analysis is included into define in the desgin thinking method. Researchers used the user persona method from the results of data collection to obtain data analysis.

C. Concept Ideation

Concept formulation is a stage that enters the ideate in the design thinking process. The conceptual formulation stage is the stage for generating ideas. The solutions and ideas that have been thought out in the previous stage will be investigated and tested to find the best way to solve the problem, in this case the researcher produces an application with the concept of voice commands from the Google Assistant and the concept of trivia for learning media for people with visual impairments named Natasha Bot.

D. Prototype Creation

At this stage, the researcher begins to design a prototype from the concepts and ideas that have been generated in the previous stage. Researchers use the Google Assistant framework to produce trial products.

E. Testing

This testing process is carried out by the blackbox testing method and usability testing. Testing is carried out in two stages, namely testing by the developer and testing by users. After going through the testing phase by the developer, at this stage the user testing plan is also carried out. Researchers are looking for a tester / user and the right place to do usability testing. Researchers also prepare

scenarios and supporting tools before direct testing to the user.

- *Developers' Perspective*
  Blackbox Testing is a test carried out by researchers to see the results of trial products by checking the functionality of the product in other words testing whether the product and its features can run properly, the Natasha Bot application was tested by researchers with the blackbox testing method which then produced an alpha version where This application has not been deployed to hosting.

- *Users' Perspective*
  User testing is carried out using the usability testing method. Usability Testing is done directly by the user with the scenario given by the researcher. At this stage, it must be done carefully and thoroughly because all forms of response and user movements when trying the application are very important to be input and solutions to make improvements to the application to be forwarded into the iteration process. Therefore, the researcher prepared a recording device and recorded the response of the user when trying the Natasha Bot application in order not to miss every small response made by the user.

F. Implementation and Documentation

At this stage, researchers carried out actual activities directly practicing the Natasha Bot application which has passed the testing phase. The Natasha Bot application is implemented directly for users, namely people with visual impairments. Documentation is done by making a written or narrative explanation that explains the application's work.

IV. RESULTS AND DISCUSSION

A. Requirements Analysis

The Natasha Bot research application was designed with the aim of accommodating people with visual impairments, especially elementary school level students, in learning activities with a more interesting and fun concept. Therefore, researchers conducted interviews, distributed need analysis questionnaires and direct observations to obtain accurate information from persons with visual impairments to one of the special schools for dissabilities in Jakarta, namely SLBN 01 Jakarta.

B. Results of Analysis

After distributing questionnaires to ten respondents from SLBN 01 Jakarta as target users of the Natasha Bot application, the results are listed in the table below.

TABLE I. REQUIREMENTS QUESTIONNAIRE RESULT

Respondents	Score of each question				
	1	*2*	*3*	*4*	*5*
1	4	5	5	5	5
2	5	4	4	4	4
3	4	5	5	5	5
4	5	3	4	4	4
5	4	5	5	5	5

Respondents	Score of each question				
	1	*2*	*3*	*4*	*5*
6	5	5	5	5	5
7	3	4	4	4	4
8	3	5	5	4	5
9	5	4	3	5	3
10	5	5	3	4	5

B. User Persona

Researchers got 10 respondents for the requirements analysis interview session for Natasha Bot application. The following figure is a persona of respondent representing students with disabilities in Elementary School for Dissabilities SLBN 01 Jakarta.

Zidan

Male, 12 years old

6th grade of elementary school

Disability: Partial blindness

Behaviour:

- Keen to learn something new
- Familiar with smartphone (Android)
- Mostly used applications:
  - Youtube
  - WhatsApp

Needs:

- Learning with easy and fun environment
- Various subject options
- Finding new experiences

Fig. 2. Persona of a student with dissability

Based on the graph of the needs of the respondents in Figure 3, it is concluded that the results of the scores for distributing questionnaires to respondents with disabilities at SLBN 01 Jakarta are 4.42 from the average answer. Based on the Likert scale, the score of 4.42 is between the ratio of 4 and 5 which states that respondents really need applications to support learning activities that suit their needs where the learning needs of people with visual impairments are certainly different from learning activities in general.
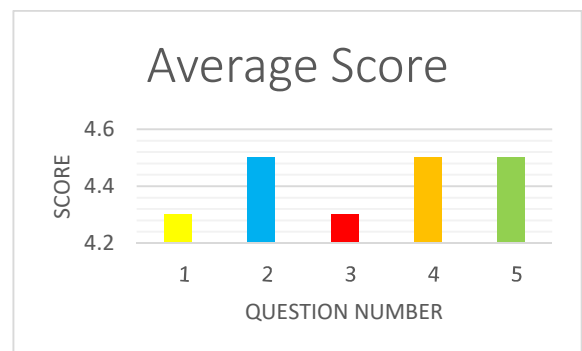

Fig. 3. Average score of requirements questionnaire

C. System Design

The use case diagram below is an illustration of what actors are doing in this application where the admin and user are depicting interactions with the Natasha Bot application.
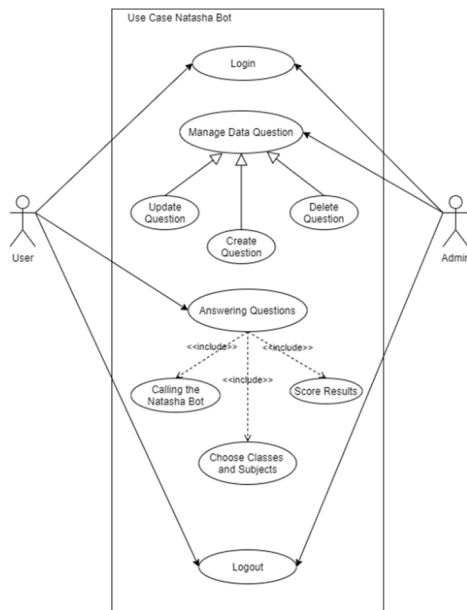

Fig. 4.   Use case diagram

Users start by calling Natasha Bot, which is then responded with a voice containing greeting templates as well as class and subject choices. Next, users can start working on questions by interacting with questions and answers with Natasha Bot using their voice. After the question and answer session ends, Natasha Bot will provide the score results from the user's answers.
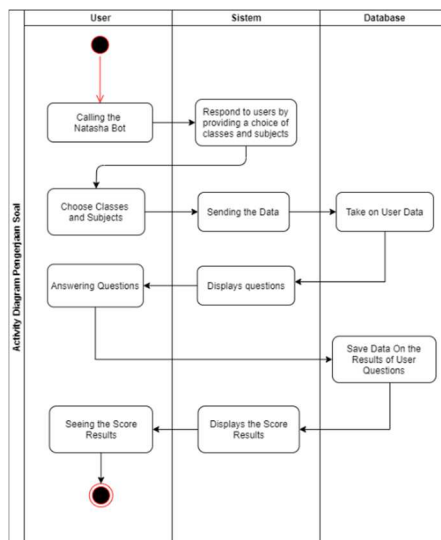

Fig. 5.   Activity diagram

D. Application Development

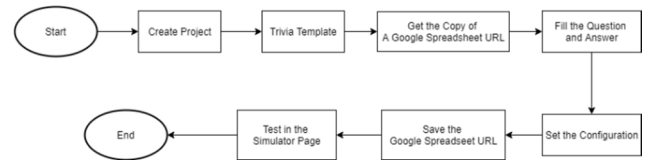Figure 6 below is the flow for building the Natasha Bot application.

Fig. 6.   Flow of Bot development

E. User Interface

The display of this application is the original view that will face the user directly. This display comes similar from the voice of Google Assistant application (in Bahasa Indonesia) with a design that researchers have created as a virtual learning media robot named Natasha.

Fig. 7.   Natasha Bot interface similar as its voice

F. Results Blackbox Testing

This stage is a testing activity carried out by researchers, namely trying the application output, whether the application and its features are functioning normally or there are errors. After going through Blackbox Testing, Natasha Bot will come out with the alpha version or Natasha Bot 1.0. Furthermore, it will be tested directly on the user with the usability testing method. Every activity of the Natasha Bot application is it running properly or not with a predetermined scenario and looking for errors from the application before release.

G. Results of Usability Testing

Testing with the Usability Testing method will test the processing of questions in the Natasha Bot application. Testing will be carried out with 20 respondents to meet the alpha testing requirements of the deployment process with the aim of releasing an official application from Google with its own Natasha Bot application brand. The next requirements that must be met include beta testing where the application is tested with 200 respondents and completes official data and permits from the institution or company that houses the Natasha Bot application. Because the situation was not possible for beta testing, the researcher conducted alpha testing with 20 respondents using the following scenario.

TABLE II. TESTING SCENARIO

Subject	User Scenario
Bahasa Indonesia for Elementary School (Grade 6th)	Users enter Natasha Bot application using their respective Google accounts then start question and answer processing of 10 questions with Natasha Bot until the score is complete.

After all respondents run scenarios using the Natasha Bot application, respondents are asked to fill out a usability assessment questionnaire. Researchers used the Computer System Usability Questionnaire (CSUQ) method to assess user satisfaction indicators on the Natasha Bot application. Of the 19 types of questionnaire statements on CSUQ, researchers took 10 types of them to assess user responses to satisfaction from using the application. The assessment of the questionnaire uses a Likert scale with a ratio of 1 - 5 in the CSUQ method [9].

Table 3 below shows the length of time for the trivia questions as well as the recorded scores from the respondents for the questions in the scenario.

TABLE III. USABILITY TESTING SCORE

Respondents	Processing Time	Score	Results
1	5 minute 6 second	6	Success
2	4 minute 50 second	5	Success
3	5 minute 10 second	6	Success
4	5 minute 45 second	5	Success
5	6 minute 3 second	6	Success
6	4 minute 5 second	8	Success
7	4 minute 47 second	6	Success
8	5 minute 48 second	6	Success
9	5 minute 52 second	7	Success
10	5 minute 15 second	7	Success
11	6 minute 5 second	8	Success
12	5 minute 56 second	7	Success
13	5 minute 43 second	6	Success
14	5 minute 25 second	7	Success
15	5 minute 35 second	7	Success
16	5 minute 3 second	8	Success
17	5 minute 10 second	9	Success
18	4 minute 5 second	8	Success
19	4 minute 15 second	8	Success
20	4 minute 8 second	9	Success

The data in table 3 shows that all respondents have successfully worked on all the questions until the results of the score come out, with an average score of 6.95 and an average time of working on the questions worth 4 minutes 55 seconds.

H. Results of CSUQ Questionnaire

After 20 respondents tried to use Natasha Bot, researchers distributed CSUQ questionnaires in the form of voice recordings and assisted QnA, researchers processed data on the same respondents. Researchers then provide a questionnaire statement to assess user satisfaction in using the Natasha Bot application.

From the results of the answers to the questionnaires that have been answered by respondents, the researcher gets the average result of each answer as well as the total average of all the answers listed in Figure 8 below. The total average of answers to all questionnaires is 4.41.
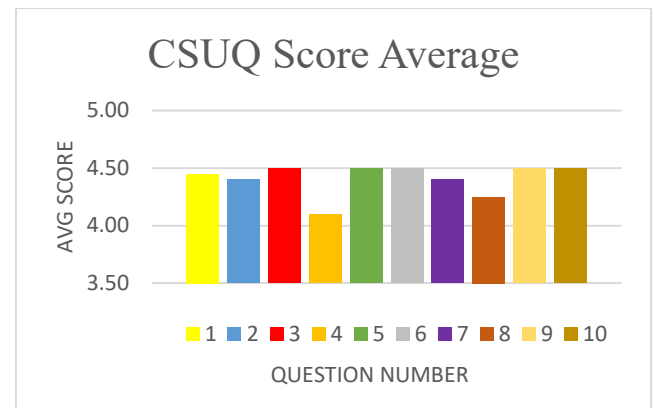

Fig. 8. Average score for CSUQ

V. CONCLUSION AND FUTURE WORKS

Based on the results of the development of the Natasha Bot application and the discussion in the previous section, the researchers concluded that people with visual impairments, especially at the elementary school level, need media or applications that can fulfill learning activities according to their needs, especially in terms of technology and psychology.

The making of the Natasha Bot application is considered to be able to help blind people, especially the 6th grade of elementary school students who still feel uncomfortable, insecure and lack of media and infrastructure in learning activities. The Natasha Bot application comes with two-way communication that resembles a virtual friend, which is considered to be able to touch the psychological and technological side of the user because it is able to act as a learning medium as well as a fun learning partner. The measurement results from usability testing stated that the respondents were satisfied with the Natasha Bot application with an average time for processing questions (time-on-task) 4 minutes 55 seconds and an average level of satisfaction result from the questionnaire is 4.41.

In this case, the Natasha Bot application with Artificial Intelligence technology made with the mobile-based Google Assistant framework can also be used by students who want to study at home because it can be accessed anywhere easily using a smartphone and connected to an internet network.

For further research, there are some suggestions related to designing Natasha Bot application to be even better. Features such as the following are recommended to be built in future studies:
a. Making Natasha Bot available in several levels, classes and subjects.
b. Natasha Bot can add the feature of selecting various classes and subjects directly in one call at the start.
c. The Natasha Bot application can provide an answer response according to the stakeholders' need (customized).

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