SMILE (Self-Monitoring Interactive Learning Evaluation) for Indonesian University Students

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Abstract— **Study in universities can be perceived as a positive challenge. However, pressures to meet academics standard, life transitions, relation with friends, and time management are potentials to boost depression, anxiety, and stress. Furthermore, students with psychological health problems were reported having worse quality of life. Therefore, it is beneficial for students to understand their conditions in order to maintain their psychological health. The ability to assess the psychological condition using tools that can be self-operated may assist a self-help monitoring and enhancing knowledge about their conditions. This research aims to develop a mobile, fast response, and interactive measurement of psychological condition regarding depression, anxiety, and stress status application in android based smartphones. The application is called SMILE (Self-Monitoring Interactive Learning Evaluation) and it uses the measurement of psychological health based on the DASS-21 (Depression Anxiety Stress Scale-21) consisting 21 questions. The Waterfall method which is chosen to develop this application software. Black-box test shows that the developed application software runs as expected. Validation result of the psychological disorder level which was examined by comparing it to the result from the test data demonstrates high accuracy.**

Keywords—Psychological disorder; DASS-21; android; mobile; interactive; fast response; waterfall; black-box testing

I. INTRODUCTION

Depression, anxiety, and stress are kinds of psychological disorder that currently being prevalent in the university (college) students. Surprisingly, almost half of the college students have been suffering these psychological disorders. Survey which were taken among medical faculty students in Malaysia, India, and Saudi Arabia claimed that the number of sufferer were as high as 42%, 53%, and 64.7%, respectively [1 – 3].

The number of psychological disorder sufferer of Indonesian college students are not much different from other countries. It was reported that almost 53 % of them get psychological disorders [4, 5]. Another fact was found that up to three fourth of psychological health problems experienced by individuals, first perform in university students [6].

Depression, anxiety, and stress levels can be measured using Depression Anxiety Stress Scale (DASS) made by Lovibond & Lovibond. It consists of two types, DASS-42 and DASS-21. DASS-42 has 42 statement questions while DASS-21 has 21 statement questions. The levels of depression, anxiety, and stress in DASS are divided into 5 – normal , mild, moderate, severe, and very severe [7].

The use of DASS-42 to observe the contribution of depression, anxiety, and stress to obesity in adolescent was conducted by Masdar, et al. in Pekanbaru. Data was statistically analyzed using Chi-square and Fisher test. The results showed that depression and stress were big contributors obesity in adolescence while anxiety contributed to determine the food intake and nutrient substance [8].

DASS-21 is a short version of DASS-42. It consists of 21 questions to scale the depression, anxiety, and stress. Each scale has seven statements describing the individual's psychological condition. Depression scale assesses despair, life devaluation, self-deprecation, lack of interest or involvement, and anhedonia (inability to enjoy an exciting thing). Anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of the influence of anxiety. Finally, Stress scale assesses the difficulty of relaxed, aroused nerves, being irritable or anxious, irritable or over-reactive and impatient [9].

Psychologists use DASS-21 to measure the scale of the psychological disorders. It consists of 21 questions to answer and it is computed manually to determine the scale. This method is time consuming, not interesting, and in some cases, making the psychological disorders more severe. DASS-21 can be used as a screener for depression in substance use disorder in patients [10].

Recently, people tend to develop an interactive and more convenient system. One of the options is by developing the application under android based smart phone. Several procedures in developing android based application and its security were reviewed in [11].

Stress meter application under Android based on combination of DASS-42 and Achievement Motivation Scale was developed in [12]. The application has a moderate level of acceptability to identify the stress level. Data which was obtained from 30 final year college students showed that the higher the level of stress the lower of achievement motivation.

One innovative way for automatic stress measurements via smartphone technology was proposed by [13]. In this work, automatically collected smartphone usage and sensor data were investigated to predict the experienced stress levels of a user using a customized brief version of the Perceived Stress

Scale (PSS). A user study has been conducted in which smartphone data and stress (as measured by the PSS seven times a day) were recorded for two weeks. It was found that there were significant correlations between stress scores and smartphone usage as well as sensor data.

The goal of this research is to develop a more convenient way to measure the level of depression, anxiety, and stress. It is an application software under android based smart phone called SMILE.apk, (Self-Monitoring Interactive Learning Evaluation). Waterfall method which consists of system analysis, design, implementation, and testing is chosen to develop this application software. It utilizes DASS-21 calculation scale to facilitate psychologists in measuring the levels of depression, anxiety, and stress of Indonesian university students.

II. SYSTEM DESIGN

The waterfall method is used to achieve the goal. This method uses a systematic and sequential approach in the development of a software.

The first step in the waterfall method is analysis where the designer or system developer analyzes what the system needs to define the specifications. The second stage is system design which is based on the system's specifications. Third stage is implementation. At this stage, the system is developed in accordance with the design that was made in the previous stage. Fourth stage is testing phase. In this stage, all functions that exist on the system that have been made are tested to make sure they are running as expected. The final stage is the stage of maintenance or system maintenance. It includes repairing errors in the system that may not be found in the previous stage or adding new functions to the system.

Since the target users of this application are Indonesian, the questionnaires are Indonesian translated version of DASS-21 by Damanik [14]. Table I lists the score and level of depression, anxiety, and stress from DAS-21 calculation.

TABLE I.   SCORE AND LEVEL OF DEPRESSION, ANXIETY, AND STRESS.

Level	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Very Severe	> 27	> 19	> 33

A. Activity Diagram

The design of work processes is a fundamental design regarding system behaviour and activities that occur when the system is run. The activities and behaviour of this system are illustrated on the activity diagram. The first activity is when the user wants to take a questionnaire, the user must log in first to access the questionnaire retrieval menu. Fig. 1 shows the activity diagram of the questionnaire retrieval.
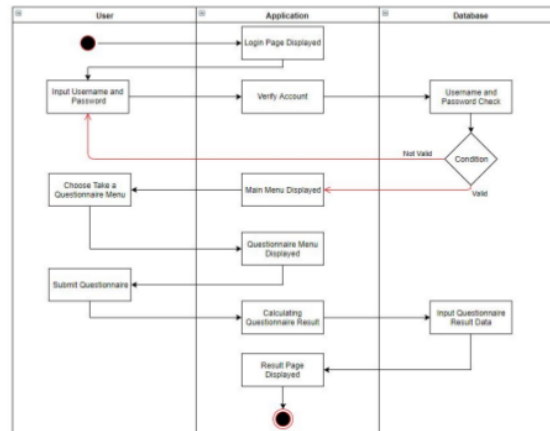

Fig. 1. Activity diagram of the questionnaire retrieval.

The second activity is when the user wants to delete the history of the questionnaire he/she has taken. The user must log into the system, enter the history list menu, and select the option to delete history.

The third activity is designed to allow the admin to change the user account data. The admin must log into the system, enter the user list menu to find the account whose data will be changed, and then select the change option to change the data from the user.

The fourth activity is provided for the admin to delete user data. After logging into the system, the admin must enter the user list menu to search for the user account to be deleted and select the delete option to delete the user.

The fifth activity allows the admin deletes the history data that has been taken by the user. The admin have to log into the system, enter the history list menu to search for history to be deleted, and then select the delete option to delete history data. Fig. 2 shows the activity diagram of deleting history for admin.
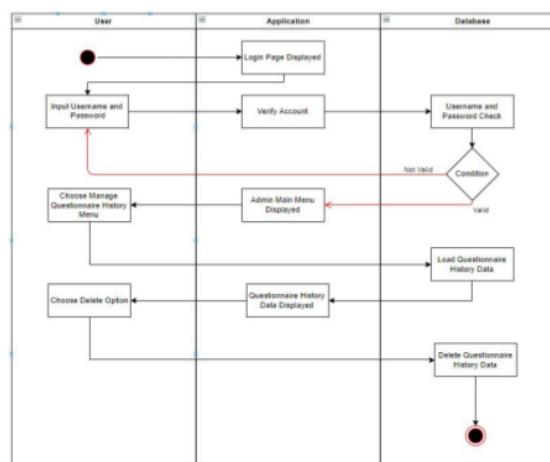

Fig. 2. Activity Diagram of deleting history.

Activity and use case diagrams cannot describe the behavior of the system. Therefore, in the design process, a

sequence diagram is used to determine system behavior in executing scenarios.

B. Sequence Diagram

Sequence diagram describes the behavior of objects in the use case by describing the life time of the object and the message sent and received between objects. The sequence diagram of the login process contains the interaction of the actor who wants to enter the system. Login will separate the access rights of each actor. The sequence diagram for the login process is shown in Fig. 3.
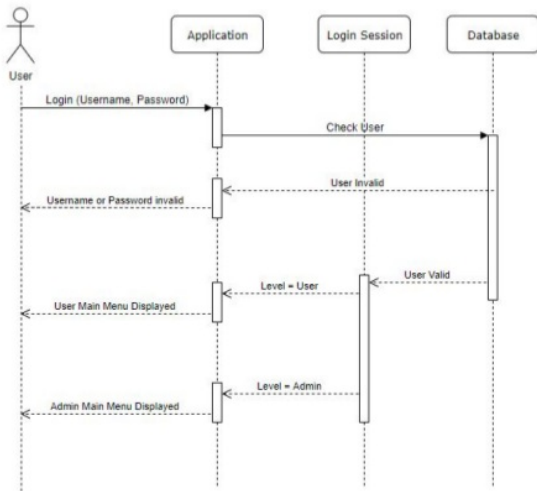

Fig. 3.   Sequence diagram of login process.

Taking questionnaires sequence diagram contains interactions when the user takes a questionnaire. The sequence diagram for the questionnaire retrieval process is shown in Fig. 4.
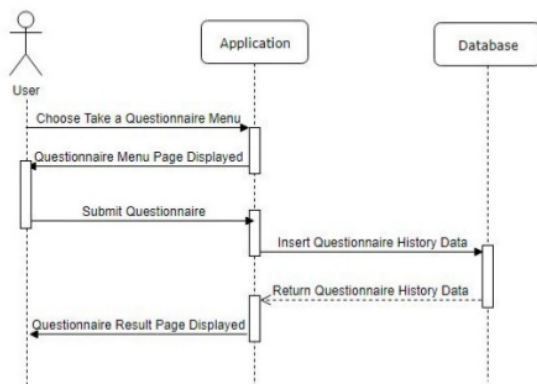

Fig. 4.   Sequence diagram of questionaire retreval.

View profiles sequence diagram works when a user wants to see a personal data profile. View the history sequence diagram takes place when the user needs to see and delete the history list. The user can see the history details that

has been taken and also delete the history. User manage sequence diagram runs when the admin chooses manage user menu. He can view user's personal data, make data changes to user, and delete user account. Manage history sequence diagram operates when the admin wants to manage history menu. He can view and delete the questionnaire history data of the users.

Demographic data sequence diagrams is executed when the admin selects the demographic data menu. He can see statistical data that informs the number of users based on the parameters of age, sex, ethnicity, education level, parental education, and parents' income. The demographic data sequence diagram is shown in Fig. 5.
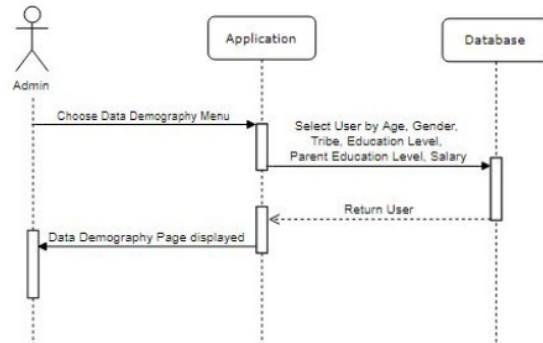
Fig. 5.   Sequence Diagram Data Demography.

The DASS-21 data sequence diagram takes place when the admin chooses the DASS-21 data menu. He can see statistical data that displays information about the number of levels of depression, anxiety, and stress that generated by the user. The DASS-21 data sequence diagram is displayed in Fig. 6.
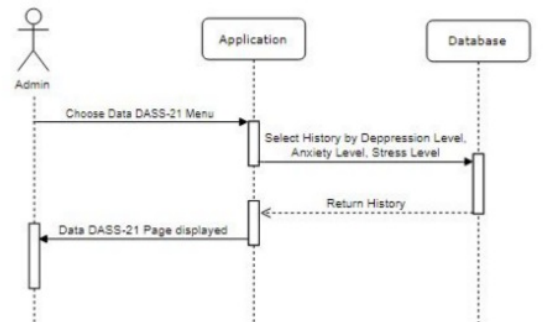
Fig. 6.   Sequence Diagram DASS-21 Data.

Deployment diagrams can be used to model additional systems (embedded systems) that describe the design of devices, nodes, hardware, as well as client or server systems. The application deployment diagram can be seen in Fig. 7.

Fig. 7.   Deployment Diagram of SMILE.apk.

The design of the database system in this application is done by making a description of the needs and interrelationships between the data using Entity Relationship Diagram (ERD). ERD of this application is depicted in Fig. 8.

Fig. 8. Entity Relationshp Diagram of SMILE.apk.

C. Users

The SMILE.apk application is designed to be simple and easy to use. Only two users are involved, i.e. admin and user. Admin has responsibility to manage the user and data base. User is the patient or anyone who wants to measure the level of depression, anxiety, and stress.

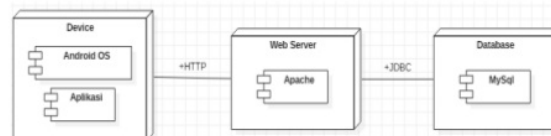The user menu structure is the menus contained on the page that are available to the user. Users are required to log in first before entering the main menu. In the main menu, there are 4 menu choices, namely taking a questionnaire, looking at profiles, view history, and logout. The user menu structure can be seen in Fig. 9.

Fig. 9. Structure of User's Menu.

The admin menu structure is the menus contained on the page that are available for the admin. Admin is required to log in first before entering the main menu. In the main menu, there are five menu choices, namely manage user, manage history,

demographic data, DASS-21 data, and logout. The admin menu structure is shown in Fig. 10.

Fig. 10. Structure of Admin's Menu.

III. IMPLEMENTATION AND TESTING OF THE SMILE APK.

This section deals with two things, i.e., the implementation of DASS-21 in digital form and testing the developed system under android based smart phone.

A. Main Menu

The main menu of the developed SMILE application is used to enter the system. Registered user can directly enter the system after login using user name and password. When the user is not recognized by the system, user must register via registration page.

B. User Menu

If registration is success, each user will be granted a personal page. Main menu of user consists of four sub menus, e. g. Take a Questioner, View profile, View history, and Logout. After finish filling the questioner digital form of DASS-21, user can verify his level of depression, anxiety, and stress. They may be normal, mild, moderate, or severe. Fig. 11 (a) shows user profile page and (b) shows level of depression, anxiety, and stress of the user in bar chart.

(a)   (b)

Fig. 11. (a) User profile's page and (b). User 's emotion condition page represents the level of depression, anxiety, and stress in bar chart.

C. Admin Menu

Admin has responsibility to manage the user and data base. After login to the system, Admin enters the main menu, which has five submenus, e. g. Manage User, Manage History, Demographic Data, DASS-21 Data, and Logout.

Admin also be able to view the Demographic data which presents the profile of all users who deals with this application. Fig. 12. (a) shows demographic data of total seven users who takes benefits form this application. Admin also can view the DASS-21 [14] of all users, as shown in Fig. 12. (b). This page represents the level of depression, anxiety, and stress of the community. From this demographic and DASS-21 data, admin can give information to the upper manager to take next beneficial actions.
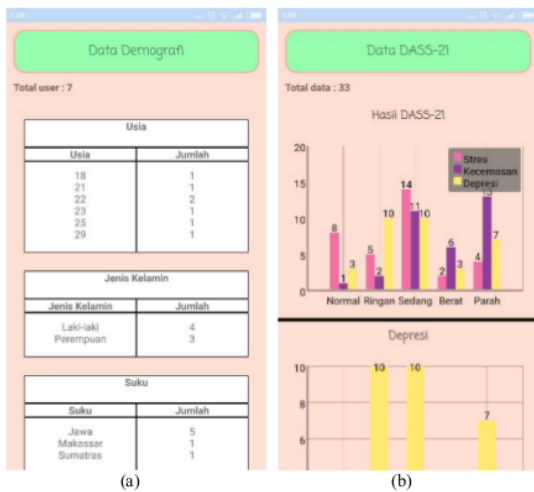

Fig. 12. Admin can view (a). Demography data and (b). DASS-21 data.

IV. CONCLUSION

The SMILE (Self-Monitoring Interactive Learning Evaluation) as an application under android based smart phone has been developed. It can be used to measure the level of psychological disorders, e. g. depression, anxiety, and stress based on DASS-21 scale by Indonesian university students. The students can obtain the results and retrieve the history of measurement in more convenient way. Validation result of the psychological disorder level which was examined by comparing it to the result from the test data demonstrates high accuracy. Further work will be developing this application by adding another calculation scale, such as GHQ-12 and implementing the application on other platforms such as Windows Mobile 10 and iOS.

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