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The Development of Skin Analyser for Skin Type and Skin Problem Detection

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Abstract

The skin is the body's largest organ and it is essential to take good care of it. Various skincare products are existing in the market that can be used. However, the wrong selection of ingredients can cause irritation and skin sensitivity that would lead to low self-esteem. Moreover, there is a lack of a platform that provides the user with knowledge regarding skin and skincare ingredients. Thus, this study aims to develop a mobile application that can analyse the face skin type. In this study, automatic face skin detection is proposed. This mobile application gives a recommendation of ingredients based on the user's skin type. The prototyping model was used as a methodology together with Android Studio as the software tool and JavaScript as the programming language. The usability testing involved 30 respondents and the results show positive feedback towards the features and functionalities of the proposed mobile application. Thus, the development of this Skin Analyser mobile application can help many young women to check on their skin and help them feel more confident.

Keywords: skin detection, skincare, skincare routine, skin type

INTRODUCTION

Women, especially teenagers and young women commonly face some issues related to their skin type. Most of them still lack knowledge about the ingredients of skin care products that are promoted in the market. The choice of suitable skincare products is very important to help them gradually lessen their skin problems. The most common skin problem faced by young women is acne (Choi & Park, 2006). When someone is having a skin problem, it will not only injure physical health but also will induce psychological problems (Wu et al., 2019). Proper skincare is needed because the skin is

the largest barrier against infection. Thus, keeping the skin healthy keeps this barrier strong (Ramlan, Kamil, Ghani, & Rahman, 2020). In addition, the lack of a platform to provide young women with suitable ingredients in skincare products is another reason that leads to skin problems. It is quite tricky to figure out the skin type because it can change over time and can be affected by climate, hormone, and diet. There are many skin care products available on the market. Wrong selection of skin care product will disastrously impact the skin. Once the skin has problems, it might reduce one's self-esteem (Mohanapriya, Padmavathi, & Prasathkumar, 2019).

Several software developers have recently become interested in the development of skin detection applications. Many technologies are currently used in the medical field, as an example the mobile technology was developed to detect skin cancer (Sawada et al., 2011) (Bourouis, Zerdazi, Feham, & Bouchachia, 2013). Besides, the mobile technology such as a smartphone has offered a good environment for the development of several and diverse new-generation applications that use computer algorithms (Islam & Mazumder, 2010). An application that runs on a smartphone with a camera can obtain pictures of skin abnormalities. The image of the lesion can be sent from the smartphone to a central server/computer, which uses a colour and symmetry-based analysis based on Artificial Intelligence (AI) algorithms to classify the image as benign or malignant. Such a system has been developed to present a perfectly functional feature-rich software application with a clear graphical user interface for analysing skin pictures (Islam & Mazumder, 2010).

The main objective of this study is to develop a user-friendly mobile application for young women who are concerned about their skin health. By using the proposed mobile application, young women can identify the category of skin type and select the skincare ingredients for different types of skin. Besides, this application provides users with skincare tips that are suitable based on the skin type. The ensuing discussions of this paper are organized into several sections. Section 2 discusses the related works, while Section 3 elaborates on the Skin Analyser development process. Then, Section 4 discusses the results of the proposed mobile application development and evaluations carried out in this study, followed by Section 5 that concludes the discussions of the paper.

RELATED WORKS

The face is one of the important parts of the body, but the facial skin is exposed directly to the air. So, facial skin has a higher risk of being damaged compared to other areas. Thus, it should be taken good care to prevent any skin problems. A study conducted to identify the attitudes of humans towards skincare training found that the training was inadequate and respondents requested it (Feetham, Jeong, McKesey, Wickless, & Jacobe, 2018). There are several factors that affect the integrity of the skin, as listed in Table 1 (Caldwell, 2005).

Table 1: Factors affecting skin integrity

Factors affecting skin integrity
• Drying / desiccation through washing
• Age and skin type
• Environment / climate/ lifestyle and occupation
• Nutrition and hydration
• Peripheral circulation/oedema
• Length of stay in hospital (immobilization)
• Level of consciousness
• Trauma
• Activity
• Faecal/urinary incontinence
• Fever / infection
• Metabolic state
• Immunosuppression
• Sensation

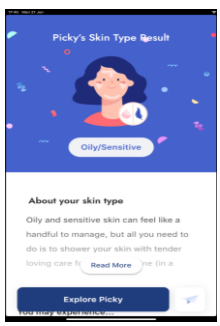
According to Lowe (2019), there are five different skin types, which are normal skin, oily skin, dry skin, sensitive skin, and combination skin. Normal skin sometimes refers to healthy skin since it can tolerate most things without overacting. The normal skin usually is blemish-free, has good oil and water balance and the ultimate goal is they have fine pores, good blood circulation, a velvety soft and smooth texture and are not prone to sensitivity. Oily skin is characterized by excessive sebum production which leads to a person's skin appearing shiny and greasy or oily. For people that have oily skin, they tend to produce excess oil on their face. Meanwhile, for the dry skin, they are described as a skin type that produces less sebum than normal skin. Dry skin is usually sensitive and may become irritated when in contact with harsh detergents, soaps, or unsuitable cosmetic products. Sensitive skin means the skin is prone to inflammation. Last, the combination means, the skin is the combination between two types of skin such as oily and dry, or oily and sensitive. The combination skin tends to be oilier in the forehead and nose, where you have more oil glands and drier on the cheeks.

Mobile applications play an important role in a user's mobile experience (Islam & Mazumder, 2010). The developments of mobile applications are rapidly increasing in number as it gives a positive impact on society. The mobile applications are really easy to use because they are running on smartphones thus people can easily use them and they can also be accessible anytime and anywhere. There are several software or sets of programs run on a mobile device and perform certain functions and tasks for the user with the target to have a smooth interactive engagement with users (Islam & Mazumder, 2010). This mobile technology is also applied in the skin detection and skin analysis field. In previous research, it is suggested that using skin colour detection is one of the suitable techniques for skin detection through mobile technology (Stawska & Milczarski, 2013).

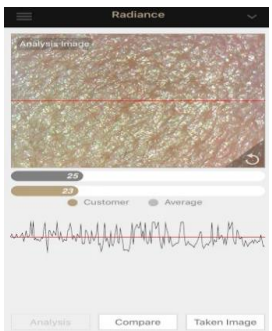
Several existing mobile applications provide the features and functionalities related to skin analysing. Most of the existing studies applied skin analysing for skin diseases detection (Hameed, Haddad, Habaebi, & Nirabi, 2019)(Mieras, Taal, Post, Ndeve, & Hees, 2018)(Bourouis et al., 2013).

But our proposed application differs since we are going to develop an application to detect the skin type. Thus, in this study, we chose the three most similar mobile applications that exist in the market as the benchmark. Table 2 shows the comparisons for the three existing applications that will be used as our comparison in developing the proposed application.

Table 2: Comparison of existing applications related to skin analysing

Application	Advantages	Disadvantages
Picky (https://www.gopicky.com/) 	● Get to know skin type via answering questions related to user skin reaction towards the environment and skincare product. ● Provide knowledge about ingredients that are in some of the skincare product range. ● Free sign-up. ● Have features that users can interact with other users to share their experiences based on treating their skin concerns.	● No camera features to scan the face.
SkinScopy (https://play.google.com/store/apps/details?id=com.skinscopy&hl=en&gl=US) 	● Get to know skin type via face scanning. ● Can analyse images of the selected area which is more specific. ● Provide knowledge about ingredients that are in some of the skincare product range.	● Need to sign up for a member account for more access and need to pay for it. ● Crashes even at the login part. ● Some of the functions don't work properly.

continue

Application	Advantages	Disadvantages
Artistry Skin Analyzer (https://play.google.com/store/apps/details?id=com.aramhuvis.solutionist.artistry2&hl=en&gl=US) 	● Get to know skin type via face scanning. ● Provide skin concerns with more details. ● Provide knowledge about ingredients that are in some of the skincare product range.	● Need to sign up as a member account and buy their specific tools for scanning the face, not free. ● The diagnostic skin tool is pricey. ● Need WiFi connection to connect the apps with the tools.

The proposed mobile application will apply the advantages of the current applications and try to overcome the disadvantages. In the proposed application, users can know their skin type and get the suggestion of a suitable skincare routine based on their skin type. Besides, general information about types of skin and types of skincare products is also provided. Thus, the user will know and apply it at home. This application is mainly focusing on the specific target users which are young women especially students and career women between 18 to 40 years old.

SKIN ANALYSER DEVELOPMENT PROCESS

The development method is important since it gives guidance to the researcher so that the data can be extracted, collected, identified, and analysed easily. In this study, the prototyping model is applied and it consists of two major activities; prototype development and iterative development, as depicted in Figure 1. This method was chosen since it can reduce the risk of incorrect user requirements. Besides, prototyping is one of the ways to reduce design errors and eliminate the failure factors in the initial design phase (Kim, 2019). Moreover, the error can be detected much earlier and it will help to reduce the maintenance cost in the future (Al-husseini & Obaid, 2018).

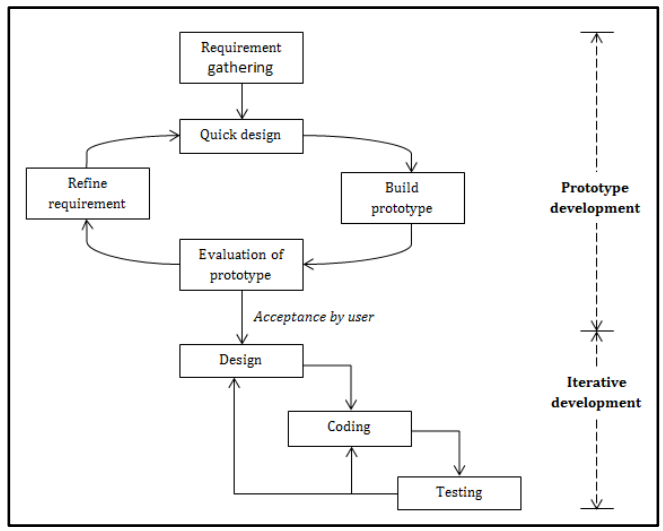


Figure 1: The prototyping model

Prototype Development

This phase starts with initial requirements gathering using several techniques including document review, system review, and interview session. Once the requirements were identified, then a quick design was carried out and a prototype was built. Then, the developed prototype was submitted to the user for evaluation. Based on the user's feedback, the requirements were refined and the prototype was modified. This cycle (obtaining the user's feedback and modifying the prototype) continues till the user approves the prototype. Figures 2 and 3 show the sample of our design and prototype.

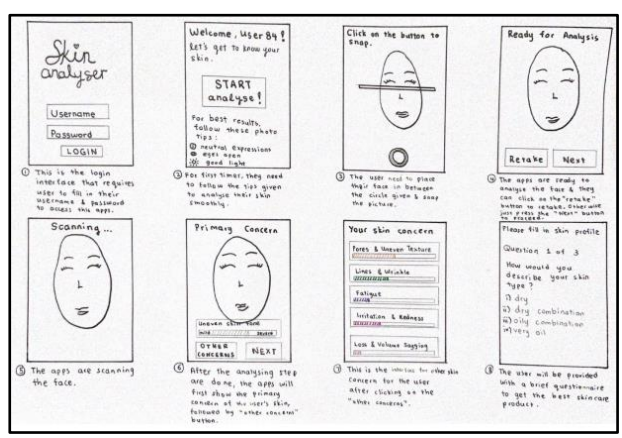


Figure 2: The proposed design of Skin Analyser

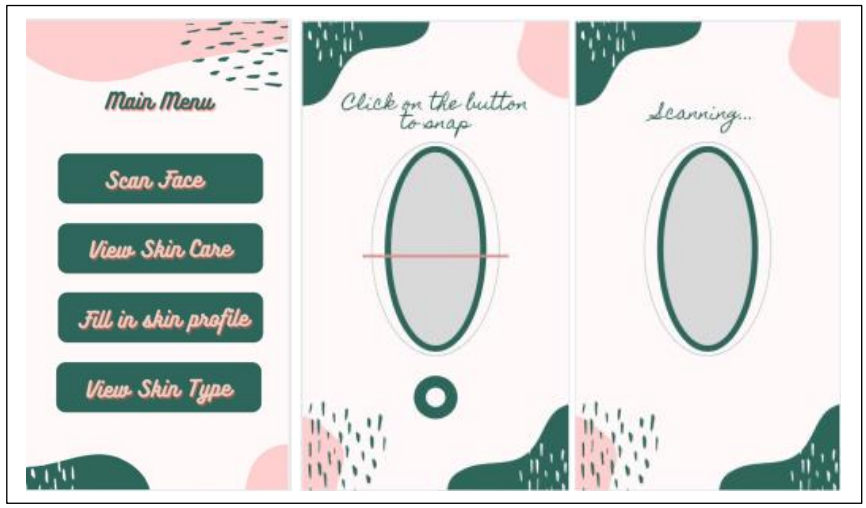


Figure 3: The proposed prototype Skin Analyser

Iterative Development

After getting approval from the user, the actual application was developed using the iterative waterfall approach. In this phase, the Software Requirement Specification (SRS) document and Software Design Document (SDD) were prepared. These two documents are crucial since it can be used to carry out traceability analysis, verification, and test case design during later phases. The multimedia elements incorporated in this application were text and images. This application gives an analysis using graphics and symbols. In addition, this application uses a symbol button to navigate to each of the subsection menus. It is more organized to use buttons to represent sub-menu as it looks more organised and easy for users to understand the content. Figure 4 shows the screenshot of the development process.

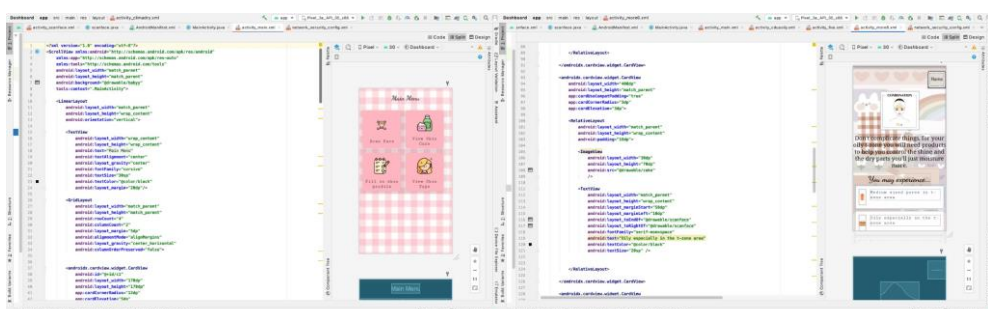


Figure 4: The coding of the Skin Analyser

RESULTS AND DISCUSSIONS

The Figures 5 and 6 show the interfaces of the mobile application as the output of this study. The output was assembled fully using Google Android Studio including the interactivity of the apps which was scripted using Java language. Pre-evaluation was conducted on a targeted user to test and check on any error that occurs throughout the development phase. Through this application, the user can identify their skin type by two choices; 1) by scanning their face (using "Scan Face" menu), or 2) by answering the questions provided in the application (using "Fill in the skin profile" menu). The result which contains the user's skin type and some related information about the skin type will be displayed. In addition, the users will be provided with some ways to avoid skin problems and the ingredients that are suitable for them. In "View Skin Care" and "View Skin Type" menu, users can view all skincare that exists in the market and also view all types of skin to add to their knowledge about it.

Figure 5: The Skin Analyser main interface and function

Figure 6: Skin Analyser interfaces for "View Skin Care" and "View Skin Type" menu

After the Skin Analyser was completely developed, the usability evaluation was conducted to identify the systems' usability among the users. To achieve this, quantitative research using a

questionnaire was conducted among 30 respondents which comprise of University Pendidikan Sultan Idris students. The result of the Skin Analyser usability testing is summarised in Table 3.

Table 3: The usability testing result

Question / Scale	1: Strongly Disagree	2: Disagree	3: Neutral	4: Agree	5: Strongly Agree
1. Is the theme used in this application suitable to use?	0 (0%)	0 (0 %)	1 (3%)	9 (30%)	20 (66.7%)
2. Is the navigation of the user interface easy to understand?	0 (0%)	0 (0%)	2 (6.7%)	5 (16.7%)	23 (76.7%)
3. Are the buttons used clearly visible?	0 (0%)	0 (0%)	0 (0%)	0 (0%)	30 (100%)
4. Do you find any difficulties while using this app?	26 (86.7%)	0 (0%)	0 (0%)	0 (0%)	4 (13.3%)
5. How is the performance of the application?	0 (0%)	0 (0%)	3 (10%)	10 (33.3%)	17 (56.7%)
6. Would you like to use this application to find out about your skin type in future?	3 (10%)	0 (0%)	0 (0%)	0 (0%)	27 (90%)

Based on Table 3, it can be concluded that most of the respondents (29 out of 30 respondents) agree that the theme used for this application is suitable. Meanwhile, 93% said that the navigation of the user interfaces is easy to understand and all respondents strongly agree that the buttons are clearly visible. When we ask about the difficulties in using this application, 86.7% said that they are not facing any difficulties. The performance of this application can be enhanced in the future since only 56.7% chose strongly agree. The last question is regarding the ability of this application to detect a user's skin type and 90% of the respondents strongly agree with it.

In summary, we can conclude that majority of the respondents can use this application well and proved that the usability of this Skin Analyser mobile application is good. However, some functions can be enhanced in the future. Thus, this Skin Analyser application can help users especially teenagers to gain knowledge about their skin type.

CONCLUSION

This study proposed a mobile application that can help users identify their skin types and provide a guideline for their skin routine. Users need to know the ingredients, functions, and benefits of skincare products based on their various skin types. To have healthy skin, the right selection of ingredients is important before incorporating chemicals into skincare routine.

As for the completion of the application, few steps are planned to be done as future work. Firstly, this application needs to have more educational content which is notes or learning content regarding further explanation about the skin concerns and how the ingredients or products will affect the user's facial skin. This helps refresh the knowledge of the user and gives a chance to users that do not have any prior knowledge about their skin type and suitable ingredients in skincare products. The developed application can also be upgraded by inserting some animation as assistance or guidance that can assist users to step by step for each function. Moreover, the application should save the user's data to make it easier for them to refer to it later.

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