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The Development of a Skincare Routine Expert System

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Abstract: Everybody wishes to have great skin. However, various factors, especially environmental exposures to bad behaviors, can unintentionally destroy facial skin. As a result, it is critical that you must take care of your facial skin regularly. Everyone has a unique skin type on their face. Normal, sensitive, dry, oily, and combination skin types exist. A facial skincare routine is essential for everyone, regardless of skin type. Our face will shine brighter, smoother, and more radiant, as regards to providing healthier facial skin. This expert system is designed to provide users with recommendations and consultations about the type of skin they have, and also advice or solutions aimed at preventing the formation of more serious issues. There are two categories of users involved: administrators and users at the user level. The system is developed with the Hypertext Processor (PHP) as the programming language and MYSQL as the database system. The development of Skincare Routine Expert System, where the website is tested, and 15 total users were involved in helping provide feedback. The benefits have been identified in the Skincare Routine Expert System where users easily identify the type of skin and provide appropriate solution recommendations from the system. Various challenges were encountered while designing this system. Some of the challenges are difficulty in developing a set of rules given too many facts related to the symptoms of the acquired disease. Suggestions can be made to improve the system proposed which can support a wide range of languages, allowing more anyone to utilize it. For example, adding Malay, Indian and Chinese because these are the three primary languages spoken by Malaysians.

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Keywords: AI, Expert system, Forward Chaining, PHP, MYSQL.

1. Introduction

Artificial Intelligence has all kinds of applications, one of which is the Expert System which has the ability to use the knowledge base obtained through data input from Experts, specifically scientific studies. There are so many diseases and we need Specialists to diagnose diseases with current symptoms. Every human being has a different skin type, knowing the different skin types is an important first step to pay attention to. Knowing the different skin types will make it an easier option to choose facial care, with the right product for the right skin type. The Routine Skin Care Expert System is a system to help a person by giving some suggestions on how to treat their facial skin. There are different routines that need to be used based on different skin types. For determining the type of skin, one needs to have knowledge of the condition of the skin. This can cause difficulty for individuals to analyze their skin type if they are unable to determine their skin condition and have no knowledge of skin symptoms. For its solution, the system proposes a system of routine skin care experts using a knowledge base. Expert systems are needed to help provide solutions and be able to identify facial skin types as well as treatment solutions or tips. According to a prior study done by Angga Kresna Dwiyanto in 2015, skin disorders are caused by a person's lack of information about the sort of disease and how to prevent it. As a consequence, it is expected that skin problems would be detected early with the use of computer technology, minimizing the risk of more serious diseases (cancer). According to the authors of the publication "Expert System of Diagnosing Skin Diseases in Humans Web- Based," the existence of this Expert System is used to determine the kind of disease, symptoms, and preventive or therapy that focuses on the skin in advance.

2. Related Work

This chapter will introduce the background research that has been done in previous works. It will also focus on the Artificial Intelligence (Expert System),Artificial intelligence is a broad field of computer science that includes expert systems. A knowledge engineer, who examines how human experts make judgments and transforms them into words that a computer can understand, is required to develop an expert system. (Abu-Naser, 2016). Expert systems find use in a wide range of fields. They're best used when an expert isn't accessible. The knowledge must be collected from domain experts in order to construct an expert system.(Aysha I. Mansour, 2019). An expert system consists of a knowledge base with collected experience and an inference or rules engine, which is a collection of rules for applying the knowledge base to each case reported to the programme. Additions to the knowledge base or set of rules can improve the system's capabilities. Machine learning capabilities may be included in current systems, allowing them to improve their performance over time, just like people do.

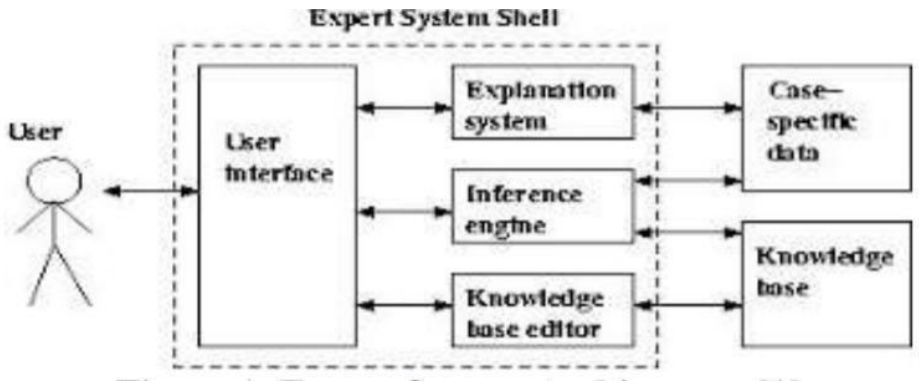


Figure 2.1 : Expert System Architecture (Mansour et al, 2019)

2.1 Expert System

The proposed Expert system is web-based and includes a database and knowledge base, an inference engine that generates suggestions, and a user interface in the form of a survey that assesses the user's skin type and recommendation. The Knowledge Base contains expert knowledge, logical rules, and a few different test versions, as well as a few different test versions. The Inference Engine is based on a forward chaining, with object classes added to the knowledge base as part of a new form of reasoning. To build distinct ES for skincare products, the system employs a forward chaining.

2.1.1 Forward chaining

Process data analysis is a system that is being run to manage or process data through the forward chaining method. Forward Chaining Method is a search method or tracking technique to front that starts with existing information and combining rules to produce a conclusion or purpose.This forward tracking is very good if working with problems starting with recording of initial information and to be achieved final settlement, because the whole process will be carried out sequentially forward

3. Methodology/Framework

The method or methodology chosen for system development will also be discussed. In addition, the research methodology conducted will also be used as a guide in developing the system. In general, this chapter describes project development management where it is important to ensure that the time used to develop the project can be optimized because time is the most valuable resource. The information system development life cycle can support system requirements, design, develop and deliver them to users. the methodology used in the development of this system is the waterfall model. This system describes the use of the Waterfall Model in the project and the activities carried out in each phase.

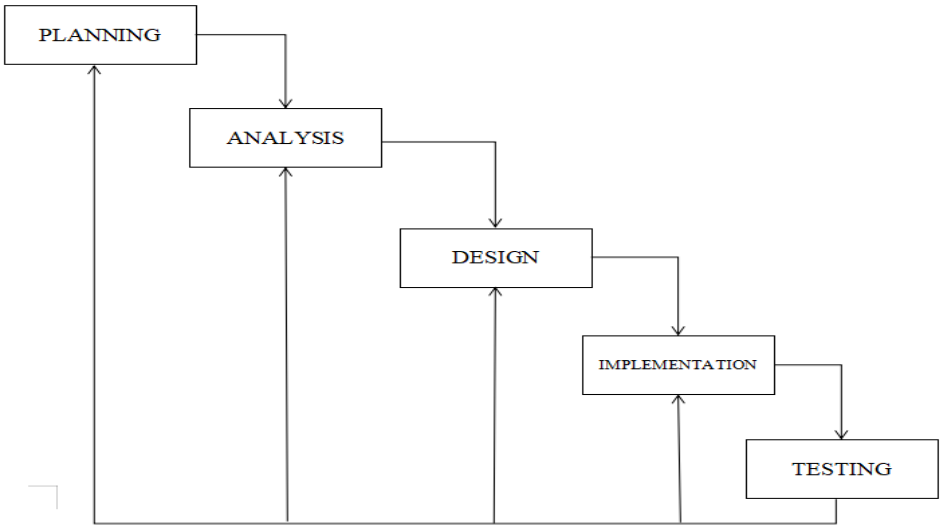


Figure 3.1 : Waterfall Model Life Cycle.

The waterfall model is a device manufacturing process software whose stage of manufacture is shaped like a water jump from the requirement stage to maintenance. The waterfall model is the very first model adopted for the software manufacturing process. Each of its stages are clearly defined and structured so that waterfall models are easier to describe for its users.

3.1 System Development Work Process

Several steps have been established in order to complete the creation of this skincare routine expert system; each phase involves actions and outcomes that must be created. As a result, table 3.1 below will provide a more precise and clear explanation of each of these phases.

Table 3.1: System Development Work Process

Phase	Activities	Results
Planning	Assess the requirements and weaknesses of the manual system	• Problem statement • Scope of the project • Project objectives
Analysis	Evaluate flaws, implementation details, and more precisely describe the flow of systems to be developed.	• Data Flow Diagram (DFD) • Entity Relationship Diagram (ERD)
Design	Documents and databases utilized in the creation of systems, hardware, software, and interface architecture should also be highlighted.	• Hardware: laptop • Hyepertext Pre-Processor (PHP) software, HTML and CSS and Mysql software

Implementation	Systems will be developed and evaluated to determine if all function as well as it intended.	● System and website are built and tested
Testing	Users will test the final systems and website to ensure that they fulfill the users' requirements and aspirations.	● System and website architectures have been developed ● Users have tested it thoroughly.

4. Analysis and Design

The result from development of skincare routine expert systems will be discussed in this chapter including the functional requirement where describing the functionalities of a system that is going to be developed and defining the specific function. Non-functional requirements will be highlighted where a requirement that specifies criteria that can be used to judge the system that will be built. The skincare routine expert system implements the structured approaches to know the process of each module in the system in more detail.

Table 4.1 Functional requirement for administrator

Functional requirement	Description
Log in	Login into the website as administrator.
Record display	Display the record of each table
Data insertion	Insert the record for the symptoms, skin concern, solution or advice and rules
Data deletion	Delete data for the symptoms, skin concern, solution or advice and rules
Data updating	Update the existing data.
Log out	Logout from admin account

Table 4.2: Functional requirement for user

Functional requirement	Description
Registration	Register a new account for user
Consultation	Answer the question and view the result based on answering the question

4.1 User requirement.

It really is critical to create and record user requirements as then it may be used to guide the program's development. Detailed explanations of the operations which that platform may enable, as well as the services that will be offered to assist them, will be included in the users ' needs. When developing an expert system, user needs are a very important step which needs to be focused because it will be used by the general public and needs to be user friendly. It can be explained that user needs determine user expectations for the application to be developed. Table 4.3 illustrates the user requirements for the proposed system.

Table 4.3: User requirement for proposed system

No.	User Requirements
1.	Users should be able to access the consultation module after logging in System.
2.	User should be able to access the access the questionnaire from the symptom of skin condition
3.	Admin should enter his own id and password for login purposes.
4.	Admin should be able to add the module in the system
5.	Admin should be able to delete the module in the system
6.	Admin should be able to edit the module in the system

4.2 Context Diagram

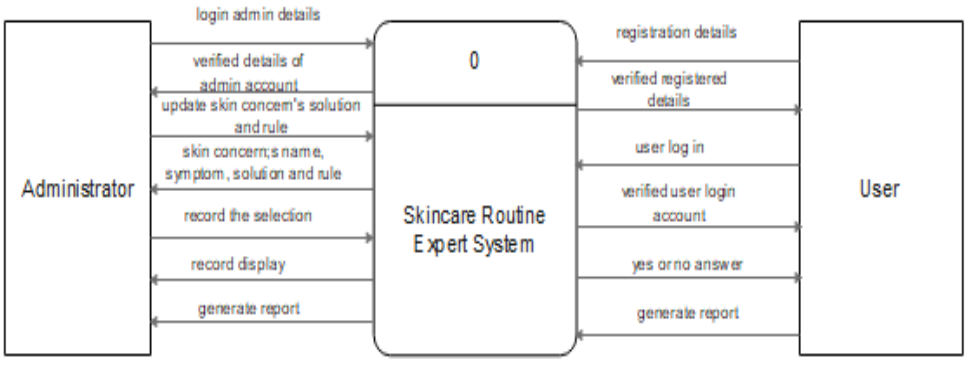


Figure 4.1 : Context Diagram.

4.3 Data Flow Diagram Level

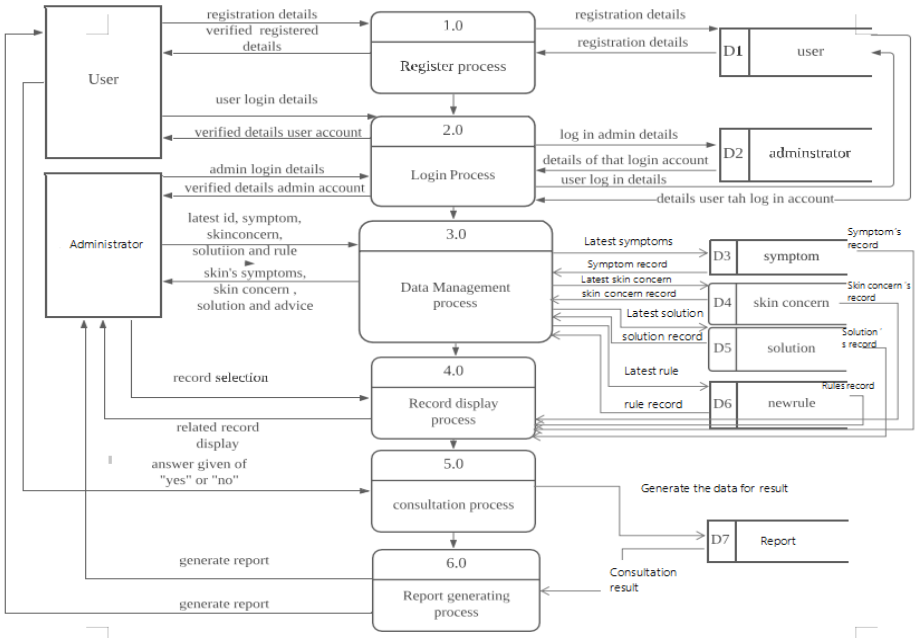


Figure 4.2: Data Flow Diagram Level 0

4.4 Entity Relationship Diagram(ERD).

Figure 4.5 shows the entity relationship diagram of the skincare routine expert system. There are seven entities such as admin, skin concern, symptom, newrule, solution, user, and report.

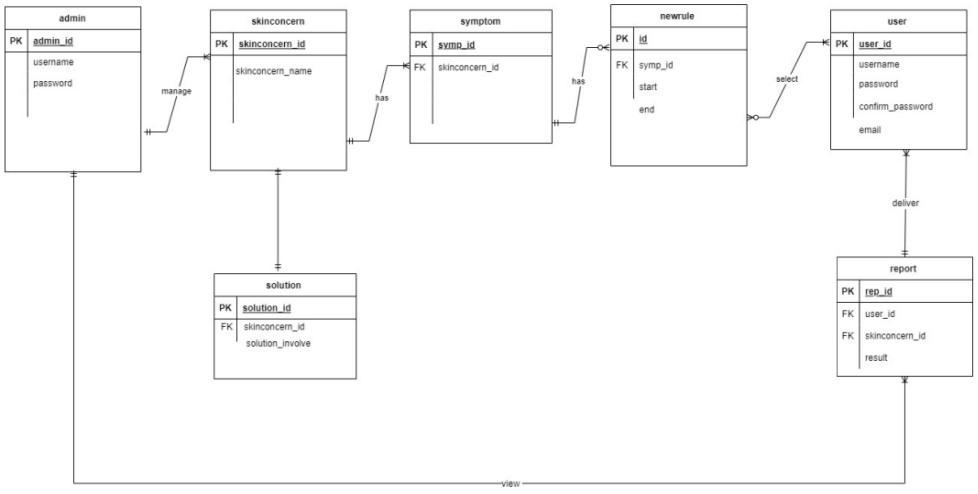


Figure 4.3: Entity Relationship Diagram

4.5 Administrator Flowchart

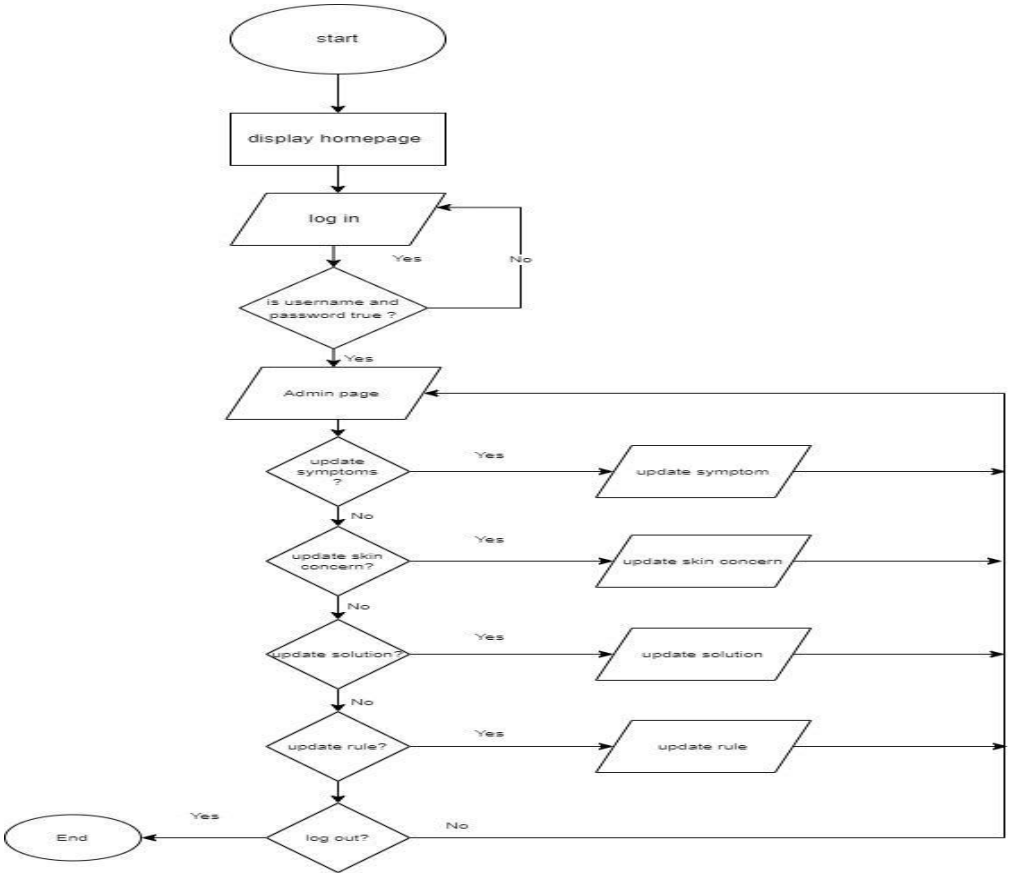


Figure 4.4 : Administrator Flowchart

5. Implementation and user testing

In a development system, there are two types of programming which have been used in the development phase which are interface programming systems and database programming. Intended interface programming to develop an interface to help users connect with the system. Meanwhile, database programming is user-friendly to manage information in a database by adding, deleting, and updating information. System testing will be run after the system is developed. Purpose testing is to get feedback from users and ensure the information entered is true. System testing to be conducted is system fungi testing and user testing.

5.1 Home page of the Skincare Routine Expert System

Figure 5.1 has shown the homepage for the Skincare Routine Expert System. Users can use the functions of this system just by clicking a button navigation available on this page.

Figure 5.1 Home page of the Skincare Routine Expert System

5.2 Consultation of interface page

The Skincare Routine Expert System's diagnosis site interface is displayed in Figure 5.2. The SELECT SQL command was used to display the database's queries and answers. If the database allows it, all questions and answers will be displayed.

Figure 5.2 : Consultation page interface

5.3 Result of interface page

The interface of skin consultation results is indicated in Figure 5.3. The problem encountered, a description of the cause of the skin condition, and a recommendation or treatment will be given as results.

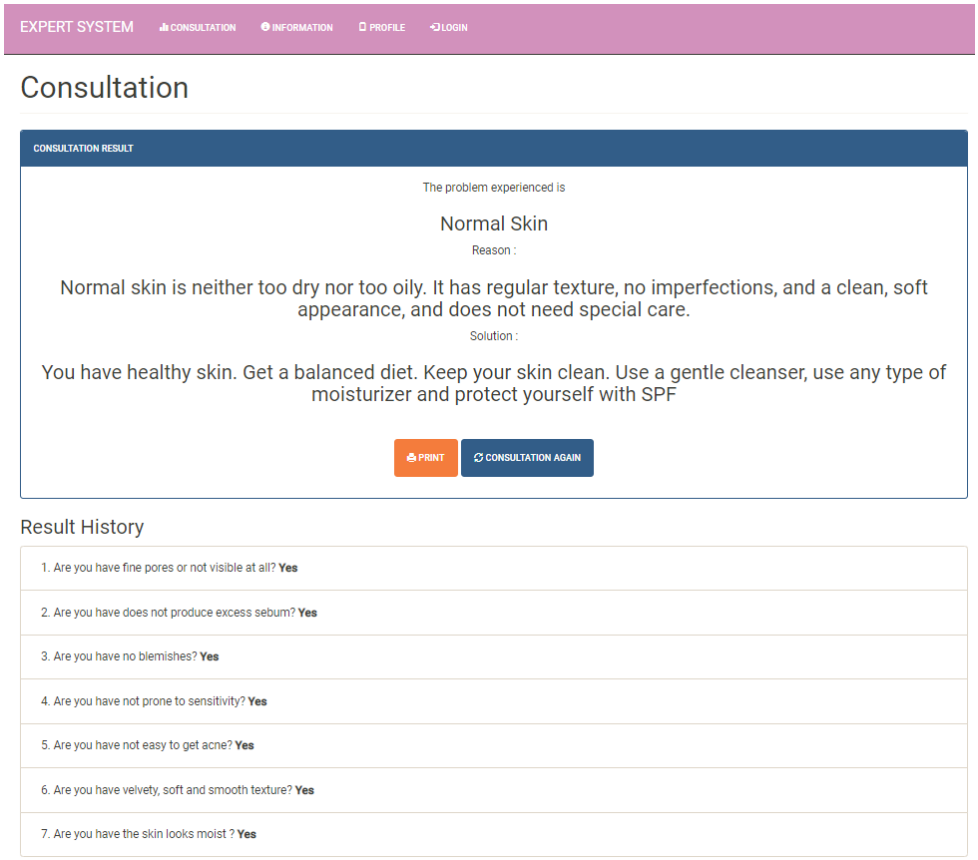


Figure 5.3: The interface of skincare consultation results.

5.4 Administrator login interface page.

The administrator login interface is shown in Figure 5.4. A username and password can be entered by the administrator. The system will continue to log in to the administration webpage after a successful login.

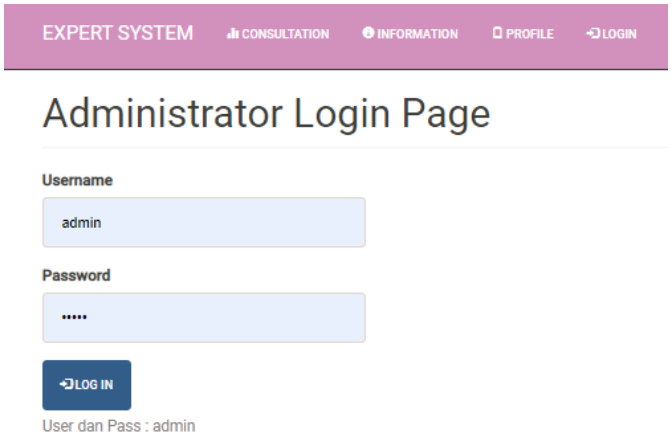


Figure 5.5: The administrator login interface.

5.5 Admin home interface.

Figure 5.6 depicts the administration main page's interface. Administrators may examine all database tables on this site, and they can also manage information. Administrators can also update the username and password on the system's headers.

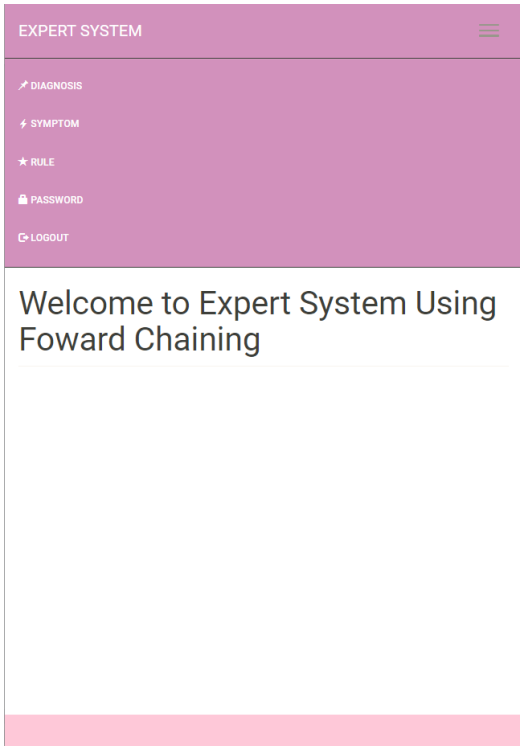
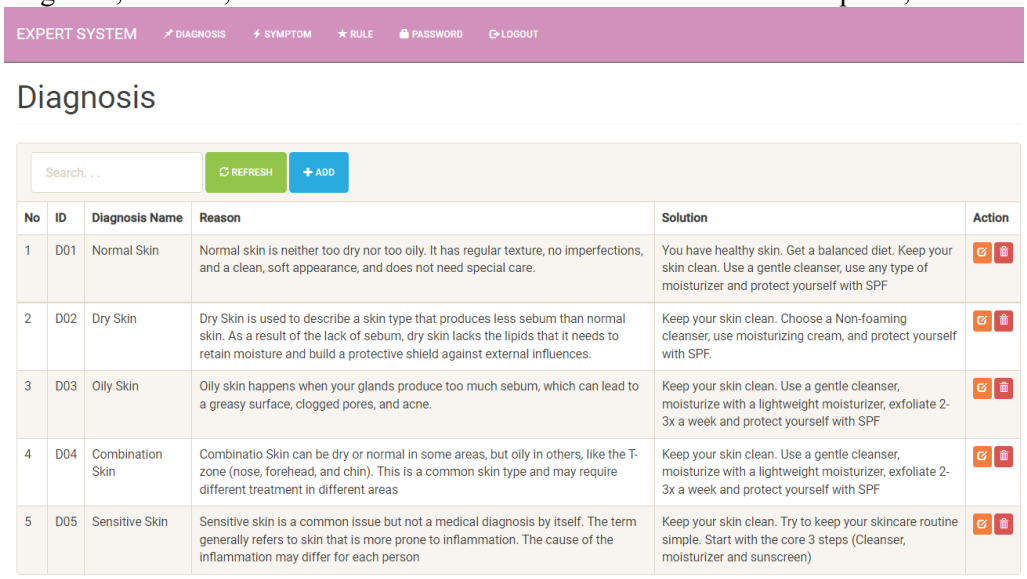


Figure 5.6 :The administration main page's interface

5.6 Diagnosis table interface

Figure 5.7 has been shown to display the diagnosis table. In this page, the SELECT SQL statement is used to display the properties that are in the table. In this table, the ID has the name of the diagnosis, reason, solution and also the action button for update, add and delete.



No	ID	Diagnosis Name	Reason	Solution	Action
1	D01	Normal Skin	Normal skin is neither too dry nor too oily. It has regular texture, no imperfections, and a clean, soft appearance, and does not need special care.	You have healthy skin. Get a balanced diet. Keep your skin clean. Use a gentle cleanser, use any type of moisturizer and protect yourself with SPF	
2	D02	Dry Skin	Dry Skin is used to describe a skin type that produces less sebum than normal skin. As a result of the lack of sebum, dry skin lacks the lipids that it needs to retain moisture and build a protective shield against external influences.	Keep your skin clean. Choose a Non-foaming cleanser, use moisturizing cream, and protect yourself with SPF.	
3	D03	Oily Skin	Oily skin happens when your glands produce too much sebum, which can lead to a greasy surface, clogged pores, and acne.	Keep your skin clean. Use a gentle cleanser, moisturize with a lightweight moisturizer, exfoliate 2-3x a week and protect yourself with SPF	
4	D04	Combination Skin	Combinatio Skin can be dry or normal in some areas, but oily in others, like the T-zone (nose, forehead, and chin). This is a common skin type and may require different treatment in different areas	Keep your skin clean. Use a gentle cleanser, moisturize with a lightweight moisturizer, exfoliate 2-3x a week and protect yourself with SPF	
5	D05	Sensitive Skin	Sensitive skin is a common issue but not a medical diagnosis by itself. The term generally refers to skin that is more prone to inflammation. The cause of the inflammation may differ for each person	Keep your skin clean. Try to keep your skincare routine simple. Start with the core 3 steps (Cleanser, moisturizer and sunscreen)	

Figure 5.7: Interface page for diagnosis table

5.7 Symptom table interface

Figure 5.8 has been shown to display the symptom table. In this page, the SELECT SQL statement is used to display the properties that are in the table.

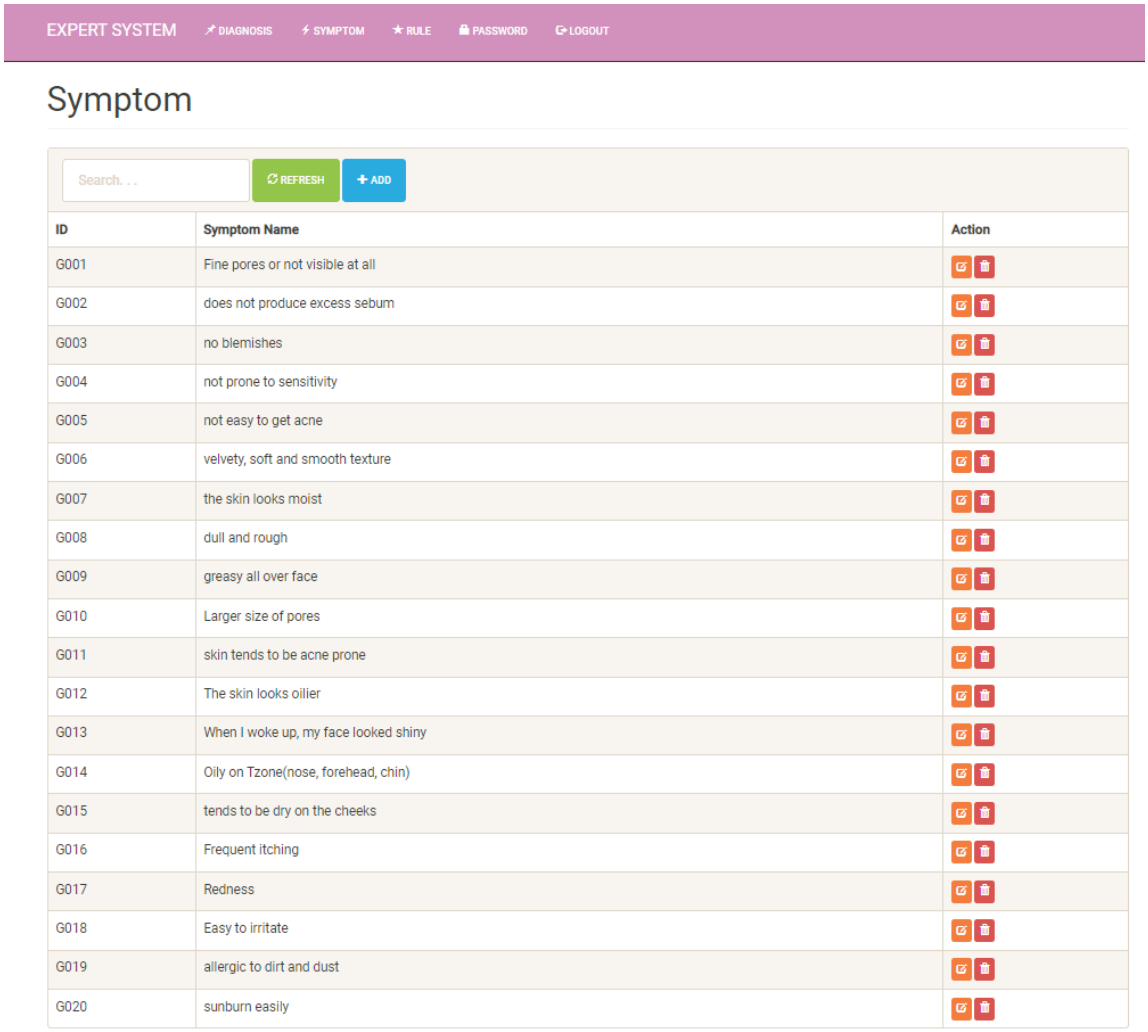


Figure 5.8: Symptom table interface page.

5.8 Rule table interface.

Figure 5.9 has been shown to display the symptom table. In this page, the SELECT SQL statement is used to display the properties that are in the table.

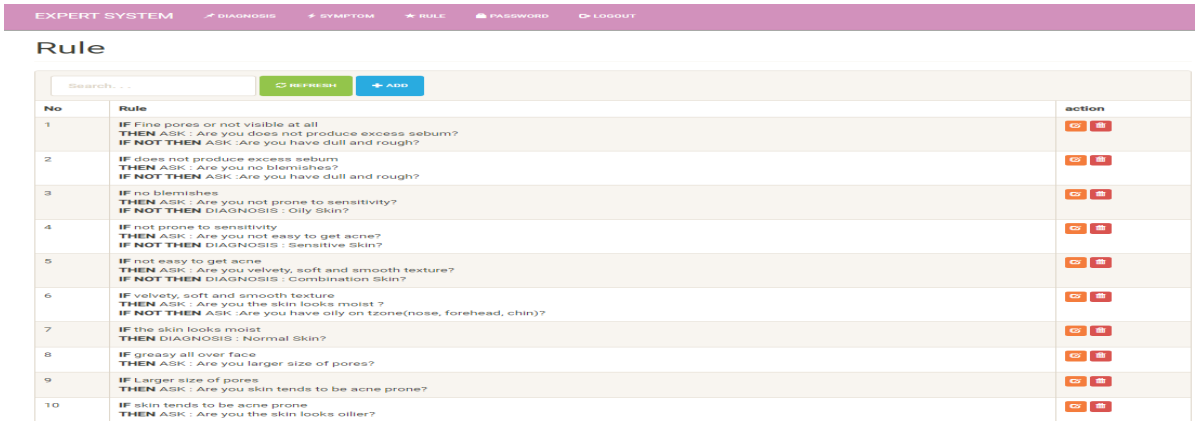


Figure 5.9 : Rule table interface page.

5.10 User Testing

User testing is testing a system that has been developed and ensuring objectives and requirements have been achieved. In addition, a also ensures that the system has met the requirements and needs of users. This test was conducted by 14 customers and a beautician. Appendix C will display the questionnaire answered by the user and a test form from the beautician. Feedback that was collected from the user after testing Skincare routine expert system summarized in Figure 5.10 to Figure 5.13. The figures show the analysis of user-based testing questionnaires from 15 users.

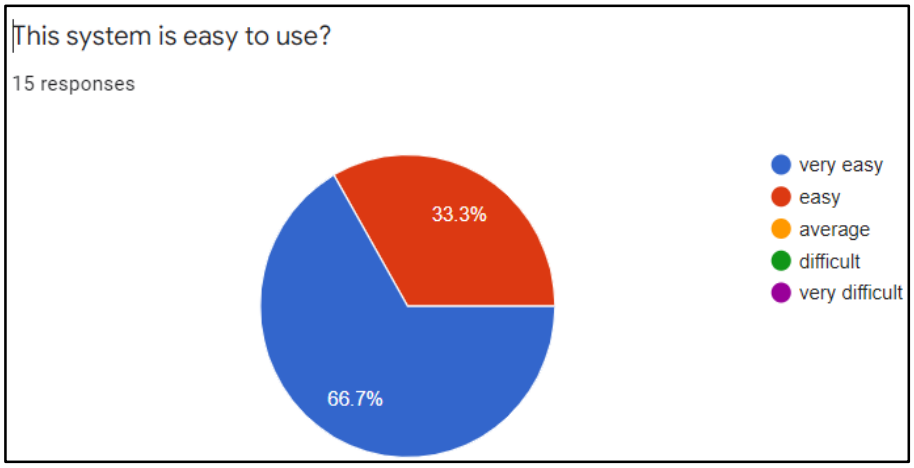


Figure 5.10: Percentage from feedback form for question" This system is easy to use?"

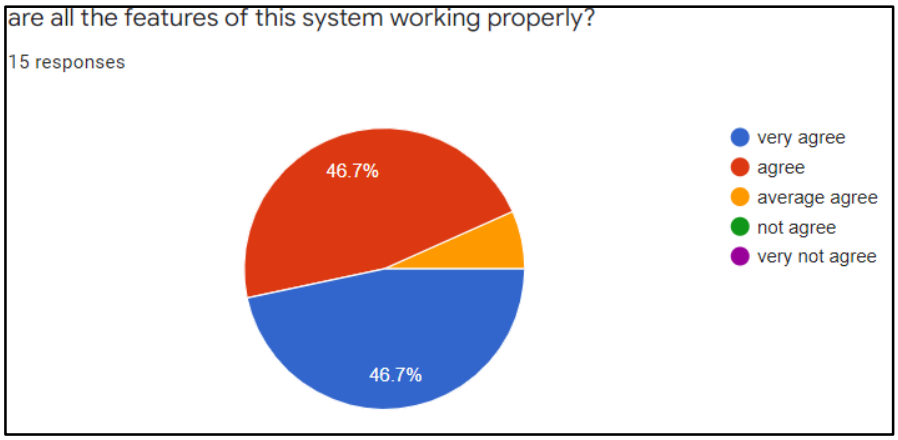


Figure 5.11: Percentage from feedback form for question" Are all the features of this system working properly?"

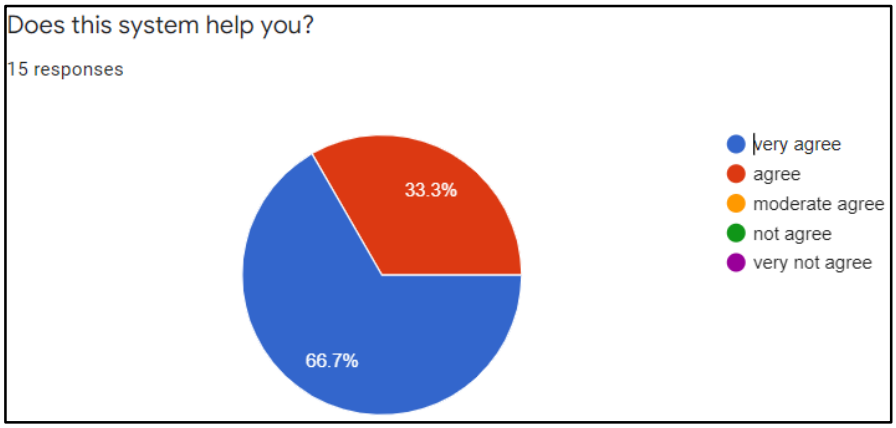


Figure 5.12: Percentage from feedback form for question" Does this system help you?"

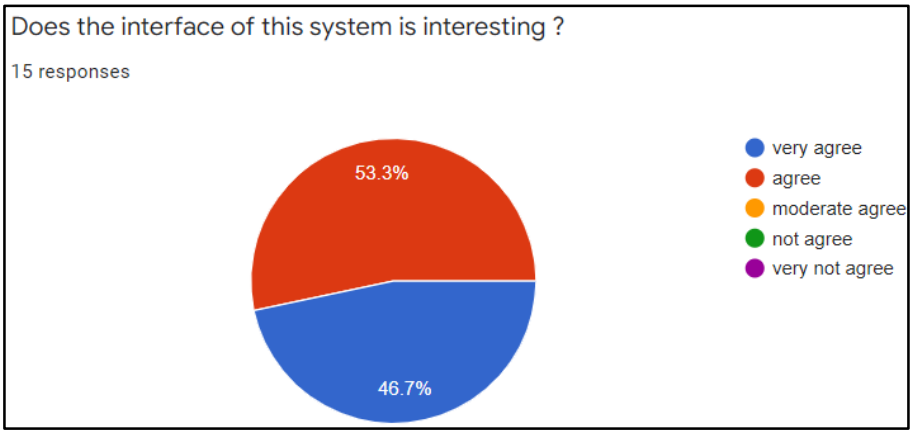


Figure 5.13: Percentage from feedback form for question" Does the interface of this system is interesting?"

6. Conclusion

Finally, the skincare routine expert system was created to allow users to request a consultation. This website, hopefully, may be developed and improved so that more people can use it to consult their skin. It is believed that web-based applications with various capabilities within the scope mentioned can be built. The website allows users to learn about the problem and possible potential treatments. This website can give users benefits and convenience.

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