

**SKIN CARE ROUTINE DECISION SUPPORT
SYSTEM USING FUZZY LOGIC**

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Computer System & Networking).

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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DEDICATION

I specially dedicate my appreciation to my parent for supporting me from the first day I'm stepping my feet in UMP and until now. Not forgotten to my project's supervisor, Madam Dr. Noorhuzaimi @ Karimah Binti Mohd Noor for willingness to guide me from the beginning this project been developed.

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ABSTRAK

Penyelidikan ini mengenai Sistem Sokongan Keputusan Rutin Penjagaan Kulit menggunakan logik kabur yang merupakan penjagaan kulit pada masa kini adalah isu penting kepada semua orang bukan sahaja untuk wanita tetapi lelaki juga. Walau bagaimanapun, walaupun isu ini penting tetapi masih ramai yang tidak mempedulikannya dan tidak tahu sama ada produk penjagaan kulit digunakan, sesuai dengan jenis kulit mereka atau tidak. Bagi penyelesaian, sistem sokongan keputusan rutin penjagaan kulit dengan menggunakan logik kabur adalah sistem yang dapat meramalkan gejala kulit empat jenis kulit seperti kulit biasa, kulit berminyak, kulit kombinasi dan kulit kering. Sistem ini akan mengesahkan jenis kulit dengan menggunakan satu set peraturan skor yang akan dimasukkan oleh pengguna berdasarkan umur, jantina, jam tidur dan keadaan kulit, maka input pengguna, akan diproses untuk menentukan jenis kulit berdasarkan kadar maksimum. Sistem sebelum ini, Sistem Sokongan Rutin Penjagaan Kulit (SCRSS), di mana sistem yang mengesan kulit dalam nilai julat keadaan kulit tidak benar-benar tepat pada julat standard dan juga beberapa gejala teras ciri yang menunjukkan jenis kulit tidak termasuk, sukar bagi pengguna yang mempunyai pelbagai jenis gejala kulit yang tidak termasuk dalam sistem. Kajian ini bertujuan untuk mengatasi masalah ini dengan menggunakan logik kabur dalam Sistem Sokongan Keputusan Rutin Penjagaan Kulit (SCRDSS). Oleh yang demikian, satu sistem telah dibangunkan bagi menyelesaikan masalah pengguna dalam menentukan rutin penjagaan kulit. Sistem Sokongan Keputusan Rutin Penjagaan Kulit (SCRDSS) menggunakan kaedah logik kabur dengan menggunakan rangka kerja sokongan keputusan. Ujian pengetahuan pengguna telah dijalankan ke atas SCR DSS yang telah ditambah baik ini. Ujian dilakukan ke atas 15 responden di mana hanya 80% responden memberi maklum balas. Keputusan ujian menunjukkan kadar peningkatan pengetahuan pengguna berkaitan kulit dan rutin penjagaan kulit iaitu sebanyak 20% berbanding pengetahuan pengguna sebelum menggunakan sistem ini. Ini menunjukkan bahawa sistem yang dicadangkan memberi manfaat kepada pengguna awam dalam menjaga kulit mereka. Namun penilaian ke atas peraturan yang dihasilkan tidak dapat dinilai memandangkan kekangan masa untuk merujuk kepada pakar kecantikan.

ABSTRACT

This research about Skin Care Routine Decision Support System using Fuzzy Logic which is skin care nowadays is important issues to everyone not only for women but men also. However, although this issue important but still many people not concerns about it and doesn't know whether the skin care products used, match with their skin type or not. As for solution, skin care routine decision support system using fuzzy logic is a system that able to determine the skin symptom of four skin types such as normal skin, oily skin, combination skin and dry skin. This system will diagnosis skin type by using a set of score rules that will be entered by the user based on age, gender, sleep time and skin condition, then the user input, will be processed to determine skin type based on maximum rate. The previous system, the Skin Care Routine Support System (SCRSS), where the system that detects the skin in the range of skin condition is not exactly accurate in the standard range and also some of the core features of the feature that indicate skin type is not included, it is difficult for users who have various types of skin symptoms that are not included in the system. This research has developed to aims to overcome this problem by using fuzzy logic in the Skin Care Routine Decision Support System (SCRDSS). As a result, a system has been developed to solve the user's problem in determining skin care routines. The Skin Care Routine Decision Support System (SCRDSS) used fuzzy logic method using a decision support framework. Test results, obtained from public respondents to determine their skin symptoms based on respondents' inputs in the Skin Care Routine Decision Support System (SCRDSS). User knowledge testing has been carried out on this improved SCRDSS. The test was conducted on 15 respondents where only 80% respondents responded. The test results show the increased rate of skin-related consumer knowledge and skin care routine that is 20% compared to user knowledge before using this system. This suggests that the proposed system benefits public users in keeping their skin. However, the assessment of the resulting rules cannot be evaluated given the time constraints to referring to a beauty expert.

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LIST OF ABBREVIATIONS

DND	Distribution Network Design
DSS	Decision Support System
FIS	Fuzzy Inferential System
HTTP	HyperText Transfer Protocol
MySQL	My Structured Query Language
PHP	Hypertext Preprocessor
PSM	Projek Sarjana Muda
SCRDSS	Skin Care Routine Decision Support System
SCRSS	Skin Care Routine Support System
UMP	Universiti Malaysia Pahang

CHAPTER 1

INTRODUCTION

1.1 Introduction

Skin Care Routine Decision Support System is a system that can determine the skin symptoms of four skin type such as normal skin, oily skin, combination skin and dry skin which based on the skin conditions and the rules that has represent into percentage. Besides that, its provide the information of skin care routines, include with the information of what should use and avoid ingredients in the product based on skin type and also the information of how to pamper the skin. This is cause, it would difficult for user to describe the skin symptoms because of do not have dip knowledge about skin symptoms. Before doing skin care or choosing cosmetics, it would be nice to know the skin symptoms first. So that, it would be easy to maintain healthy skin if user follow every routines that need to be considered based on skin symptoms.

This research proposed of using fuzzy logic method in Skin Care Routine Decision Support System to diagnosis skin symptoms, identify the skin care routine and the chemical ingredients use in the product where the ingredients suitable with the skin or not. Other than that, the information of skin care routines, which from step by step routines are provided for user to take care the skin. Talk about skin care routines, some people become lazy to do facial skin because of too many step to follow. Actually, not too many if user have enough knowledge about skin symptoms and think what good for skin it might be good for them.

As we know, skin care routine is the most important thing need to take care carefully, but nowadays, people become more attracted to the an element that call cosmetic. In the daily life, especially for women and teenager are often used cosmetic and it is becoming a trend for most people. As mentioned by the expert dermatologist,

that some Asians tend to overdo the usage such as like the whitening ritual. For approximately users, they randomly picked products to be used without thoroughly exploring the usefulness and the negative outcomes of the usage.

Moreover, its important to study the ingredients because they need to understand for each ingredients that contain in one cosmetic are good enough to apply onto users' skin. As frequently, before the people start to make for decision so first the new products should be analyzed, before it going to promotion or get ready for launch event to make sure the products not dangerous to the users' skin.

Therefore, by developing a decision support system that focus on rules, it may help the user to determine the skin symptoms. After user inserts the all information inside the support system, result of skin symptoms will display from system and the user can know what suitable ingredients user should use to skin. This decision support system can help in solving this problem.

1.2 Problem Statement

Fatin Farhana (2016) has proposed a system for helping public to use correct skin care routine. The system that has been developed able to detect the range of skin type by using the symptoms. However, the outputs produced are not given the accurate to the percentage value. The percentage value is generated from mostly frequent symptom for each skin type. This is because, the system for detected of maximum percentage value for dullness skin was not accurate to the standard range and also some of skin condition categories for determine skin symptoms are not included. Besides, it's hard for user that has different categories of skin symptoms which is not including in the system.

Moreover, users use support system because want to know about skin symptoms but when user wants to make decision, there are not enough categories to choose. So, the system still not achieves and can make user not satisfied with this system. This research analyses the set of the rules for the next implement system and existing one. A new method approach based on fuzzy logic to provide the rules and added several of

skin condition categories for each skin symptoms rules for user satisfactions, based on thesis paper.

1.3 Objective

Skin Care Routine Support System has been developed by using method decision support system (DSS). For this research, fuzzy logic used to set the new rules based on percentage value skin condition categories. Thus, the rules created based on the high percentage value that chosen in the categories. To ensure this can be achieve successfully several objective needs to be meets. There are three objectives that has been determined. The objectives are:

- i) To identify the skin symptoms based on percentage value in skin conditions and the information of skin care routine.
- ii) To develop the skin care routine decision support system using fuzzy logic.
- iii) To evaluate fuzzy logic based on user comparison user knowledge.

1.4 Scope

- i) The study is to determine the skin symptoms of four skin symptoms such as normal skin, oily skin, combination skin and dry skin.
- ii) The information of skin care routine, what should use and avoid ingredients has in used product and also how to pamper the skin.
- iii) The knowledge of public respondent measured by using goggle survey form before and after using the support system.
- iv) The rules construct based on skin conditions categories.

1.5 Thesis Organization

This research consists six chapters which are Introduction, Literature Review, Methodology, Implementation and Testing, Result and Discussion and Conclusion.

REFERENCES

- Berner, E. S., ESB. (n.d.). *Clinical Decision Support Systems: Theory and Practice (Health Informatics)* 3rd ed. 2016 Edition (3rd ed.). doi:978-3319319117
- Cabral, M. M., MC, Bos, A. J., JG, Amano, H., HA, Seino, S., SS, & Shinkai, S., SS. (2017). Relationship between skin color, sun exposure, UV protection, fish intake and serum levels of vitamin D in Japanese older adults. *Nutrition & Food Science*, 47(3), 409-422. doi:10.1108/nfs-09-2016-0136
- Christian Surber, J. K. (2017). Skin care products: What do they promise, what do they deliver. *Tissue Viability*, 26, 29 – 36
- Christos C. Zouboulisa, C. R. (2018). Age influences the skin reaction pattern to mechanical stress and its repair
- Irmawati. (2 Januari 2015). Sistem Pakar Untuk Menentukan Jenis Kulit Wajah Yang Sesuai Pada Bedak Viva Dengan Menggunaka Metode Certainty Factor. V(2), 54-58.
- Jain, R., RJ. (2015). A Fuzzy Logic Based Approach for Selecting the Software Development Methodologies Based on Factors Affecting the Development Strategies, *Decision*-70-75. doi: 10.18411/d-2016-154
- Juan Ramón Castro, J. e. A. M., & Figueroa, E. (2016). Towards an Intelligent Making Support in Health Information Systems Lightweight Hybrid Data Mining Class Library for Object-Oriented Applications.
- Mehdi Neshat*, G. S. (September 2015). A New Skin Color Detection Approach based on Fuzzy Expert System. *Indian Journal of Science and Technology*, 21
- Noor, N. M., Muhamad, N. J., Sahabudin, N. A., & Mustafa, Z. (2018). Development of Skin Care Routine Support System. *Advanced Science Letters*, 24(10), 7830-7833. doi:10.1166/asl.2018.13026

Robertson, K. (2017). How The Derms Do It: 4 Expert Dermatologists On Their Daily Skincare Routines.

S. Santini, A. P. e., A. S. Valente V, Abate, G. I., Maria Triassi, & P. Ricchi, A. F. (2014). Using fuzzy logic for improving clinical daily-care of β -thalassemia patients.

Taha Samad-Soltani, M. G., Mostafa Langarizadeh. (2015). Development of a Fuzzy Decision Support System to Determine the Severity of Obstructive Pulmonary in Chemical Injured Victims. 3, 138-141. doi:10.5455/aim.2015.23.138-141

Ustundag, A. (2014). A web-based DSS for fuzzy distribution network optimization. Enterprise Information Management, 260 – 274

Wiyanti, D. T., DTW, & Agustin, E. W., EWA. (2016). Sistem Pakar Diagnosa Kulit untuk Menentukan Kosmetik Perawatan Wajah dengan Metode Certainty Factor dan Fuzzy Logic, 62-66. Retrieved November 1, 2018.