

## TESIS^ APPROVAL STATUS FORM

JUDUL:

DECISION SUPPORT SYSTEM- INTELLIGENT CONSULTATION

SESI PENGAJIAN:

2004

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^ Tesis dimaksudkan sebagai Laporan Projek Sarjana Muda (PSM)

# **DECISION SUPPORT SYSTEM – INTELLIGENT CONSULTATION**

**YEOH LI-CHENG**

This report is submitted in partial fulfillment of the requirements for the  
Bachelor of Information Technology (Software Development).

**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY  
KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA  
2004**

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**DEDICATION**

To my beloved family members...

## ACKNOWLEDGEMENTS

*I would like to express my sincere appreciation to the following people for their guidance, support and advices throughout my project development.*

*First of all, I would like to express my gratitude to my Projek Sarjana Muda supervisor, En Mohd Khanapi Abd Ghani for his supervision during my project implementation. I would be grateful for his consultation and opinions in helping me to prepare my project report and develop the project.*

*Last but not least, I would like to express my gratefulness to my family and friends for their support and positive feedback in completing my project successfully.*

## ABSTRACT

This project is about development of Decision Support System - Intelligent Consultation (DSS-IC). DSS-IC which incorporates intelligent feature is a decision support system that consists of three main modules. Firstly, it uses a set of clinical findings (symptoms or signs, diseases and drugs) to produce lists of diagnoses. Secondly, it manages patient master index (PMI) such as the patient profile and patient family medical history. Thirdly, it maintains patient medical record (PMR). The main focus is to guide and to help decision-making of medical personnel, especially new doctors who are inexperienced in consulting a patient. Patient's condition will be diagnosed following a set of suggested questions based on selected criterions. When required questions are answered and selections are made, this indicates the end of the consultation. The system will then recommend probable diseases suffered by patient, treatments and medications for the patient. Thus, clinical notes comprises patient health summary will be displayed. This real time record will be kept into a central database as patient health history in a distributed computing model so that different medical personnel in different location can be able to monitor patient health progress from time to time. While for the back-end system, it has a database to keep all data used by the system. For this project, DSS-IC includes not only medical help or references but also support decision-making process when it comes to patient consultation. The methodology applied in development of this project is the Object-Oriented Software Engineering (OOSE). The description and rationale for choice of hardware, software, guidelines, decision-analysis, algorithms, logic rules and standards are specified.

## ABSTRAK

Projek ini menerangkan pembangunan Decision Support System- Intelligent Consultation (DSS-IC). DSS-IC yang memiliki ciri-ciri 'bijak' mempunyai tiga modul utama. Pertama, DSS-IC menggunakan pengetahuan perubatan (simtom, penyakit and ubat) untuk melakukan proses diagnosis. Kedua, ia menguruskan maklumat pesakit seperti maklumat peribadi pesakit dan juga maklumat sejarah perubatan ahli keluarga. Ketiga, ia mengekalkan rekod perubatn pesakit. Fokus utama system ini adalah untk membantu doktor terutamanya yang kurang pengalaman dalam proses mendiagnosis pesakit. Keadaan pesakit akan didiagnos berdasarkan satu set soalan yang dicadang oleh sistem. Setelah semua soalan dijawab, sistem akan mencadangkan penyakit, cara perubatan dan ubat yang sesuai kepada keadaan pesakit. Akhirnya, satu catatan klinikal akan dihasilkan untuk disimpan ke dalam pangkalan data utama sebagai sejarah perubatan pesakit. Pangkalan data memiliki ciri teragih supaya doktor di tempat lain dapat mancapai maklumat pesakit di tempat yang berlainan. Dalam system ini, terdapat juga ciri-ciri buku elektronik yang membolehkan pengguna belajar sambil menjalankan tugas yang dinyatakan sebelum ini. Metodologi yang diaplikasikan dalam projek ini ialah Kejuteraan Perisian Berdasarkan Objek. Penerangan terperinci tentang perkakasa, perisian, analisa keputusan, algoritma, petunjuk dan piawai dispesifikasikan.

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## LIST OF ACRONYMS

|          |   |  |
|----------|---|--|
| ANN      | - | Artificial Neural Network                          |
| CBR      | - | Case-Based Reasoner                                |
| CD       | - | Compact Disk                                       |
| CDSS     | - | Clinical Decision Support System                   |
| CME      | - | Continuing Medical Education                       |
| DSS      | - | Decision Support System                            |
| DSS - IC | - | Decision Support System - Intelligent Consultation |
| ERD      | - | Entity Relationship Diagram                        |
| GUI      | - | Graphical User Interface                           |
| HTML     | - | Hypertext Markup Language                          |
| IE       | - | Internet Explorer                                  |
| IT       | - | Information Technology                             |
| JSP      | - | JavaServer Pages                                   |
| OOSE     | - | Object-oriented Software Engineering               |
| PDA      | - | Personal Digital Assistant                         |
| PMI      | - | Patient Master Index                               |
| PMR      | - | Patient Medical Record                             |
| PSM      | - | Projek Sarjana Muda                                |
| RAM      | - | Random Access Memory                               |
| SQL      | - | Structured Query Language                          |
| UML      | - | Unified Modeling Language                          |
| USPD     | - | Unified Software Development Process               |



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# CHAPTER I

## INTRODUCTION

### 1.1 Overview

Nowadays, information technology (IT) is widely used in various domains and has helped us in accomplishing and alleviating our daily routine. In medical field, technology researches are carried out to enhance the already existing medical processes.

In this project, the study is done in the area of medical consultation. This project is about development of Decision Support System - Intelligent Consultation (DSS-IC). DSS-IC which incorporates intelligent feature is a decision support system that consists of three main modules. Firstly, it uses a set of clinical findings (symptoms or signs, diseases and drugs) to produce lists of diagnoses. Secondly, it manages patient master index (PMI) such as the patient profile and patient family medical history. Thirdly, it maintains patient medical record (PMR). The main focus is to guide and to help decision-making of medical personnel, especially new doctors who are inexperienced in consulting a patient. Patient's condition will be diagnosed following a set of suggested questions based on selected criterions. When required questions are answered and selections are made, this indicates the end of the consultation. The system will then recommend probable diseases suffered by patient, treatments and medications for the patient. Thus, clinical notes comprises patient health summary will be displayed. This real time record will be kept into a central database as patient health history in a distributed computing model so that different medical personnel in different location can be able to monitor patient health progress

from time to time. While for the back-end system, it has a database to keep all data used by the system.

DSS-IC is applicable for medical institutions such as hospitals, clinics, polyclinics and telemedicine centres. However, a polyclinic, which provides general medication, is chosen as a reference to this project.

As for my personal experience, DSS-IC is useful when it comes to consultation by inexperienced medical personnel when it happened that one time my illness was inaccurately diagnosed and led to inappropriate medication. If this happens to other patients, they might have suffered more serious complications if early appropriate diagnosis and medication is not recommended. DSS-IC will at least recommend all possible diseases, treatments and medications and; help medical personnel to decide the most appropriate outcomes and medication methods.

The existing medical help or references are only available in the form of electronic book (e-book) and encyclopaedias. For this project, DSS-IC includes not only medical help or references but also support decision-making process when it comes to patient consultation.

The methodology applied in development of this project is the Object-Oriented Software Engineering (OOSE). The description and rationale for choice of hardware, software, guidelines, decision-analysis, algorithms, logic rules and standards are specified.

## 1.2 Problem Statements

- a. Inconsistency of decision-making on same problem: Doctors intuitively employ complex decision-making strategies based on common sense and past experience, instead of fixed organizational and medical guidelines. While the doctor would still be able to decide on the course of action to be undertaken, DSS-IC would present the standard decision approved by the organization, which results a more consistence outcome each time a consultation performed.
- b. Long consultation hours: Generally, consultation hours for a patient depend on activities carried out during the consultation such as reviewing patient's information, patient's previous medical record, questioning and answering session, urine testing, blood testing, scanning, etc and at last come to doctor's decision-making for the consultation. If all these processes have to be performed for a consultation, DSS-IC will at least save doctor's time in decision-making for the consultation process. In addition, time for consultation includes retrieving patient information and patient previous health record.
- c. Long patient waiting time: DSS shortens consultation hours in doctor's decision-making. Thus, subsequent patient will not have to wait too long for their turn for consultation.
- d. Communication problem: Communication problem might occur when doctor consults patient of different races who don't know each other languages or patient who are unable to speak. This will cause a problem for the doctor if no aiding tools are available throughout the consultation. Misunderstandings arise might lead to inappropriate diagnosis and wrong medication or treatment which will result in unhelpful solution for the patient. DSS-IC will at least help the doctor with patient body languages or other ways of telling doctor about their problems.

### 1.3 Objective

The objectives of developing this project are as follow:

- a. Provide more comprehensive and faster outcomes for decision-making: With the help of DSS-IC, a more complete recommendations or outcomes can be generated.
- b. Provide medical personnel with the right information at the right time: According to patient's to-date condition.
- c. Reduce patient queuing time for medical consultation: When consultation can be done faster. The next patient will not have to wait for too long for their turn.
- d. Improve greater business efficiency: When time is saved in doing consultation, it will improve greater efficiency that might affect the business.
- e. Improve clinical performance and medical outcomes in clinical settings such as computer-assisted dosing and preventive care reminder: When DSS-IC recommends disease, treatment/prevention and medication results.
- f. Generate electronic patient health record: Printable clinical note is generated at the end of consultation and be kept into database as patient medical record.

## 1.4 Scopes

The project scopes here are described as project focus, project boundary and aspects to be studied. The scopes of this project are described as follow:

- a. Consultation decision support system: Consultation handled by medical personnel is done through answering a set of required questions based on patient's condition. Besides, study is carried out to prepare sets of logical diagnosis questionnaires and information in order for the system to recommend more accurate outcomes. The main interaction mode between Decision Support System - Intelligent Consultation (DSS-IC) and user is mouse point-and-click. The secondary interaction mode is minimal keyboard entry for entering patient master index record, medical personnel's comment. The flow of DSS-IC is as follow:
  - Medical personnel click the chief complaints that explain the patient's major problem on a human body diagram.
  - The will lead to answering of a set of questions associating the chief complaints suggested by DSS-IC.
  - Based on answers, DSS-IC will recommend patient health summary in clinical notes. From here, the system helps medical personnel in deciding most accurate outcome to best describe patient health condition, treatment and appropriate medication.
- b. Patient Master Index (PMI) Management: PMI consists of patient profile and patient family medical history. First time visitor should register and patient profile will be kept. After consultation, patient health summary is generated as clinical notes and medical personnel need to save the patient health summary as patient medical record (PMR). These records are kept for future reference by other medical personnel in different medical institution to monitor the progress of patient condition periodically.

- c. Patient Medical Record (PMR) Maintenance: With patient medical record as real time record, no data is to be managed instead of just maintenance. For the time being, outdated record will be deleted only by the administrator.
- d. Database: The second major emphasis in developing DSS-IC is the database development because of its requirement to store required data. The data that will be kept are clinical findings (symptoms or signs, diseases and drugs), patient master index (PMI) and patient medical record (PMR). The database is carefully designed to support storage and information retrieval. The database is developed using Microsoft SQL Server 2000.
- e. Electronic-book / Medical reference: DSS-IC has characteristics of an electronic-book (e-book) / medical reference. DSS-IC provides description of clinical findings but should not be considered complete due to a number of possible causes as follow:
- A lack of coverage of all symptoms or signs, diseases and drugs.
  - The inadequacy of the system to cope with all variations in the way the disease can present due to presence of a second interacting disease, or because of the failure to include the appropriate relationships between previous patient's encounters.
- f. Information sharing: This project covers only workgroup environment to support sharing of information and distribution of patient information throughout a medical institution.
- g. Data collection or health knowledge: The primary prospective in developing DSS-IC is data collection for clinical findings (symptoms or signs, diseases and drugs) needed for recommending outcomes and design questionnaires. These data are kept in a central database.
- h. Ease Of Use: Another emphasis of this system is on the Graphical User Interface (GUI). The GUI is written in Visual Basic version 6.0 in Microsoft Windows

Environment, allowing for a natural integration of the database, thus providing combined storage and information retrieval. The GUI presents a choice of several windows to enter or to display the various types of information. The system is user-friendly and allows flowing from window to window and back to any section desired.

## **1.5 Contributions**

The significance of studying this project is to enhance clinical consultation; recommendation of treatment and prescribing practices through a decision support system that will recommend more accurate outcomes.

The contribution of this study is to improve the existing medical help or references into integration of patient consultation process that can improve clinical performance and guide medical personnel to a more accurate and proper decision-making.

## **1.6 Expected Output**

The expected output of this project is a system that can be able to support medical consultation, patient master index (PMI) management, patient medical record (PMR) maintenance and electronic-book / medical reference features.

## **1.7 Conclusion**

Chapter I concludes the overview or the brief picture of this project, identification of problems, objectives to be achieved, definition of scopes, the contributions and the expected output forecasted for this project.