CLINIC MANAGEMENT SYSTEM:
ELECTRONIC MEDICAL RECORDS SYSTEM

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ABSTRACT

An Electronic Medical Records system (EMR) is a computerized system designed for user to manage the records of the patients in systematic ways and to make the user easy to records the patient information. This Electronic Medical Records system (EMR) has been applied with the indexing technique based on the Rule-based conditions. A research and analysis on the current system and indexing technique was done to get the better understanding of the system. The Rapid Application Development (RAD) methodology was used in this project development implements iterative development which is used in the system that always changes from time to time. Testing is done every phase of development life cycle to make sure that the system working properly. This project was developed using Macromedia Dreamweaver and Oracle 9i as a database platform. As a final result, this system was fulfilling all the research objectives. This research was successfully developed the Electronic Medical Records system (EMR) prototype system, computerized and optimized the current system using indexing technique based on the rule-based conditions.

ABSTRAK

Sistem rekod perubatan secara elektronik ini adalah diaplikasikan dengan mengunakan sistem berkomputer bagi memudahkan penguna untuk merekodkan maklumat pesakit dan menyusun maklumat pesakit secara sistematik. Sistem rekod perubatan in bergantung dengan sistem yang lain kerana sistem ini merupakan sumber maklumat kepada sistem yang lain. Indeks teknik berdasarkan 'Rule-based' juga telah diaplikasikan dalam thesis ini. Kajian dan analisa tentang sistem semasa dan indeks technique berdasarkan 'Rule-based sistem juga telah dilaksanakan untuk mendapat pemerhatian dan pemahaman yang lebih baik. Pembangunan Aplikasi Rapid metodologi telah digunakan untuk membangunkan sistem ini yang juga sesuai digunakan untuk sistem yang permintaannya selalu berubah mengikut keadaan semasa. Projek ini telah dibangunkan mengunakan Macromedia Dreamweaver dan Oracle 9*i* sebagai pengkalan data. Fasa ujian telah dilakukan pada setiap peringkat pembangunan untuk memastikan sistem ini berfungsi dengan baik. Fasa ujian untuk sistem ini berjaya dilaksanakan dengan jayanya sehingga fasa yang terakhir dan berjaya mencapai kesemua objektif sistem ini.

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LIST OF ABBREVIATIONS

EMR	-	Electronic Medical Records
JSP	-	Java Serve Page
RAD	-	Rapid Application Development
SDLC	-	Software Development Life Cycle
OPD	-	Out Patient Department
ICU	-	Intensive Care Unit
DBMS	-	Database Management System.
DOB	-	Date of Birth
PC	-	Personal Computer
OLAP	-	Outline Analytical Process
HTML	-	HyperText Markup Language
DBA	-	Database Administrator
ASP	-	Active Server Pages
IIS	-	Internet Information Server

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Clinic management system is a one (1) of the system that needed in the nowadays management. The clinic management is the system that has been applied in the hospital management. In the hospital management have been divide into few phase which are registration, ward, blood bank, pharmacy, EMR(electronic medical report), OPD (Out Patient Department), Radiology, ICU, Rehab and staff management. In the ward phase, there have a few sub phases which are surgery, pediatric, orthopedic, ophthalmology and many more.

The usage of the electronic system in the hospital is still new and not very popular. Currently, there are only two (2) such hospitals, namely, Selayang Hospital and Putrajaya Hospital. Hospital Sultan Ismail, when completed and fully operational by early next year, would be the third [10]. Other hospital only applied certain module in the certain part of the system management. Example of the some system that exist in the some of the phase in the hospital department are laboratory info system from the lab department, pharmacy inventory system in the pharmacy department and financial report system in the registration part.

Many hospitals still used the paper usage to record all the medical report about any patient. If the doctor needs the information the staff has to find the

information and give to the doctor. This process takes a few times only to search report of all the patient treatment. This EMR module facilitates the user or the doctor to record the patients' details about the present illness and the past history. User or doctor has to enter the data using clearly defined work flow. In the EMR system all the details about the patient has be retrieving from the other department example from the blood bank, ICU, wards, radiology and other department. It also contains the information of medicines that have been taken by the patient.

This information is very useful to the doctors or the user to refer all the history information about the patient. In the EMR system there has the search part which help the user to find the specific patient and after that they can viewed all the details about the patient. The EMR system also has to come with the manageable database that can record the database in the efficient way.

1.2   Problem Statement

The EMR system is the one (1) of the most important application if it can be applied to the hospital management system. The EMR include all the details of each patient begin with the first time they get the treatment until now. Usually, before this all the information about the patient will be safe by writing in a piece of paper.

The paper has been kept in the place that has been placed all the report paper of the patient. If the report need to be used the staff need to find the report in the specific place that contains all the patients information in the hospital. This has been referred by one of the doctor and also the lecture in the International Islamic University Malaysia (IIUM) in Kuantan which is Dr. Jamaluddin Abdul Rahman. By using the EMR system can make the process of finding the patient details become faster than the manual ways.

However there is an EMR system that have been applied in the certain place but the EMR system is not involve all the information from each department in the clinical management. There also have the EMR system in the markets that retrieve all the information from all departments that included in the patient details. The example of the system is too specific and it also involves a lot of form that have to key in by the user.

This ways make the user hard to do the process and need more time to fulfill the form. This EMR system also has been applied in the overseas. This system cannot be applied in the Malaysia because the features and also the usage of this system is not same as the Malaysians EMR process.

1.3   Objective

The objectives of this module are:

(i)   To implement rule based condition in the indexing technique for record system

(ii)   To develop a prototype Electronic Medical Records (EMR) system and to test the functionality.

1.4   Scope

The scopes for EMR system are:

(i)   This system is used by registration phase to records the patient details. These records have included patient age between 1 to 60 years old and level of the sickness. Involve records patient, list the patient and register profile.

(ii)   This system has been used by the medical staff

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Electronic Medical Records (EMR) system is used to record all the details and the treatment in each patient in the hospital. This EMR is very important to know the history health of each patient, what types of medicines that he takes what type of sickness and many more. This information will be covered all department that involve in the hospital. In Malaysia this system is still new, but in the overseas this system has been used in some healthy care centre. This EMR system can be used to view and to give many functions for those who applied it.

2.2 Current Systems

There are many example of software product that has been produce to apply the Electronic Medical Records system. OmniMD Electronic Medical Record and SOAPware Electronic Medical Records are the example of current system of Electronic Medical Records. These are some explanation of these current systems:

2.2.1 OmniMD Electronic Medical Record

This OmniMD Electronic Medical Report is a product that has been produce by the OmniMD Physician Empowered Company. This company applied the internet based application which means that this system was quickly accepted by users both within and outside of the EMR system.

It used to automate and simplify the patient record document, storage and retrieval process. The EMR acts as the backbone to delivering immaculate patient care, establishing efficient processes and maximizing profitability. These are the system advantages compare to other system:

(i)   Universal Accessibility

This EMR can be used for user easy accessibility across locations. The doctors can view or edit patient data from a desktop or tablet PC as per their convenience.

(ii)   Informed Decision Making

By ensuring swift patient record documentation at the point of care the EMR eliminates the burden of illegible writing, paper processes or unorganized records. A one-click search allows instant retrieval of patient notes, medications and vital documents ensuring that the physician makes the best-informed clinical decisions.

(iii)   Specialty Specific Customization

The Patient data is captured in forms customized to each specialty e.g. Cardiology, Neurology. The point and click format data capture in these forms reduces the transaction time by over 60%.

(iv)   Ensured Compliance

Working in a high volume, high-pressure environment it is often possible to overlook minute details in patient documentation. This also ensures reduction in malpractice insurance premiums.

(v)   Interpretive Reporting

The reporting system is an essential tool for business analysis and future planning. The system allows users to formulate exhaustive reports by demographics, insurance and data accessed.

(vi)   Integrated Workflow

The system ensures superior coordination among doctors, nurses and other staff. Multiple user rights dictate the features available to every user and ensure seamless workflow with minimal coordination hassles.

(vii)   Scope for Research Initiatives

With exhaustive electronic documentation clinics can invest in clinical research. Access to complete patient records, clinical data and reports helps clinics to pursue intensive research with ease.

This EMR system covered fifteen departments in the clinical management system. The departments involve are cardiology, dermatology, endocrinology, gastroenterology, family practice, internal medicine, neurology, gynecology, .ophthalmology, orthopedics, pain management, pediatrics, psychiatry, pulmonology and urology.

These are the some features in their EMR system which is point and click forms with macros that allow the users to click on logical phrases and choices to record patient encounter in the form. The logical line of thought selected by users form a written narrative. Then it has patient dashboard that provides access to patient's demographic information, insurance records, allergies, medical history, transcriptions, prescriptions, super bills and documents.

In the medical history is used to maintain an exhaustive update on the patient's medical history across vital parameters such as statistics, medical problems, allergy details and lab reports. The visit record is also one (1) of the features which are used to document each visit of a patient for quick reference such as medical examination, new symptoms and illness history. The insurance records are used to produce detailed track of the patient's insurance policies containing his plan and termination date. This is integrated with the billing systems.

It also has the quick records search which applied the searches that can performed cross multiple parameters to retrieve patient records in seconds. The doctor records features is used to maintain the database of all doctors which involve permanent doctors and visiting doctors with details of address, contact details, qualification, and specialty. Patient Intake Forms Patient data can be filled at the clinic's website by the patient and directly updated on the EMR.

2.2.2 SOAPware Electronic Medical Records

This software product has been product by the DOCS, Incorporation. This EMR system is design for the usage of clinic. It is designed to evolve the practice and eventually replace paper charts. It provide robust tool to link to billing system, hospital, labs and others.

This product has the features that helps keep track of the status task within SOAPware:-

(i)   It also locates the patient summaries which used to track all the pertinent historical information on the patient involve with this system.

(ii)   It also has the note generation features which can quickly document a
         patient encounter with rebuilt templates and codes. The generated
         report is also more legible and structured than a handwritten one.

(iii)   This product can reduces the amount of time spent searching a record
         for valuable information because all pertinent data on one screen.

(iv)   It also has the patient pictures that can import a patient's picture into
         demographics section of their chart.

(v)   This product also has the features of storing ancillary reports for quick
         review which from the lab, radiology and pathology. All codes,
         protocols, report were completely customizable that can generate
         patient information with the user on their own.

2.3   Indexing File organizations

Index is a data structure that allows the Database Management System
(DBMS) to locate particular records in a file more quickly and thereby speed
response to user queries [3]. This index concept of a database is similar to an index
in a book. It also is used to determine the location of rows in file that satisfy some
condition.

The index allows lookup of items based on a particular attribute type which is
the property of the query, and covers objects. It also could be reached from that node
following a particular type of link by using the browsing interface which the range of
the query itself [2]. By using the index also it can help in searching data and adding
data to the database based on the condition itself. Each index entry matches a key
value with one or more record.

An index can point to a unique record which is primary key or to potentially one (1) or more record. An index that allows each entry to point to more one (1) record is call secondary key index. This is used to support many report requirements to provide rapid ad hoc data retrieval [7]. Some relational Database Management System (DBMS) use the primary key index which is different from a primary key index to designate an index that determines the physical location of data but the secondary index which is distinct from secondary key index is an index that plays no role in determining the storage location of data.
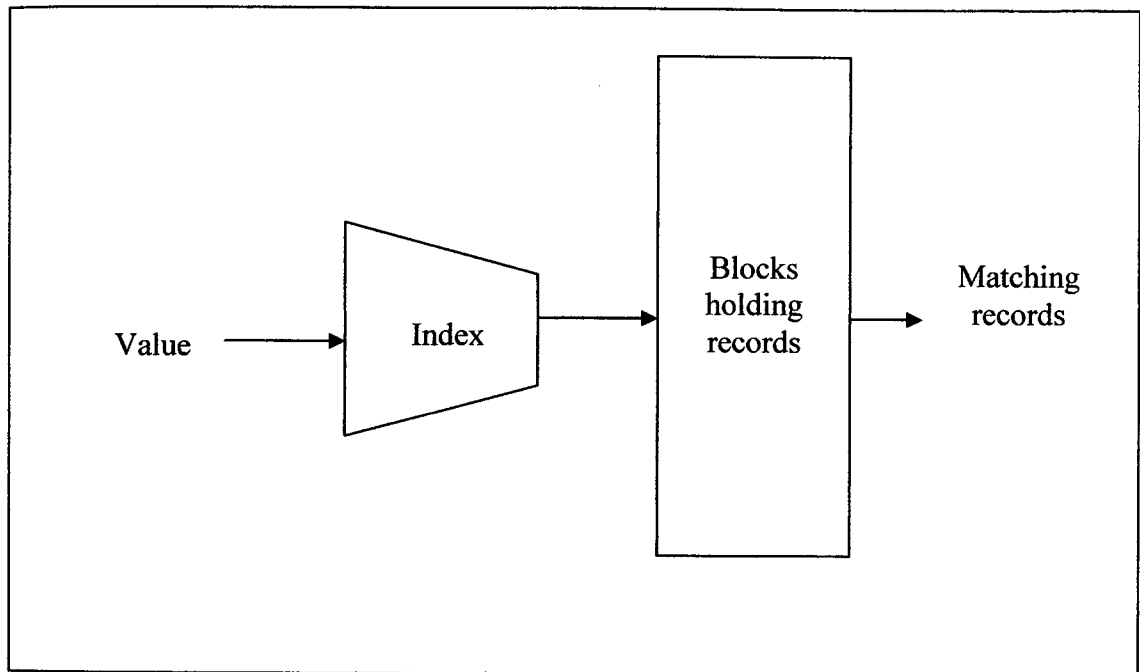
Figure 2.1: An Index takes a value for some fields and find the records with the matching value [5].

The primary index can be used as a primary key of the table or can not be and same also as the secondary index that used the unique field or not unique across the rows of the table. An index structure is related to the search key and contains the record that related to the key value and the address of the logical record in the file that have the key value, refer to Figure 2.1 for the flow of index process

2.3.1 Index Structure

These are the example of the index structure which is simple indexed on sorted files and secondary indexes on unsorted files.

2.3.1.1 Simple indexed on sorted files

This file has been called as a data file and also know as index file which consist of key-pointer pairs. The simple indexed on sorted files consist of sequential files, dense indexes, spare indexes and multiple levels of indexes.

Sequential file is an index that depends on the file being sorted on the attributes of index. This structure is useful when the search key is the primary key of the relation and also can be used to the other attributes [5]. A sparse index has an index record for only some of the search key values in the file. It also holds only one key-pointer per data block. The key is for the first record on the data block.

A dense index has an index that is used to record for every search key value in each data block. The index blocks of the dense index maintain these keys in the same sorted order as in the file itself. The last is the multi levels of index that is used to reduce the search range for the index that involve with the large file of index. It can be applied same as other indexes file and splits the index into a number of smaller indexes and maintains an index to the indexes [3].

2.3.1.2 Secondary Indexes

This index also same as primary index which is simple index on sorted file. The secondary index not contains unique values and it also a data structure that facilitates finding records given a value for a one or more place [3].

The secondary indexes are always being a dense index but usually with duplicates. The secondary index is design in pairs where the index file is sorted by key value, which to help find the entries given a key. The secondary index also has been applied in the document retrieval and inverted indexes. This is because the advent of World-Wide Web and the feasibility of keeping all documents on-line, the retrieval of documents given keywords have become one largest database problem. Mostly a number of efficient indexing techniques used the inverted file and the direct key access. Both this method also provides a good performance to the standard of the relational techniques of Btrees and Hash indexes [1].

(i)   Inverted file text indexing and Document Retrieval

The inverted index consists of a set of word pointer pairs which it is effected by the search of the key index. The inverted index is kept in a sequence block similar as other index. However, in some document-retrieval applications, the data may be more static than the typical database, so there may be a provision for overflow of block or changes to the index in general [5].

This index also have been used in the full text database system which is used to storing or and accessing document collections such as newspaper archives, office automation systems, and even libraries of books and articles. For a full-text database system, indexes should efficiently support three (3) kinds of activity. First (1), given a Boolean query on a set of words, the index should efficiently support retrieval of

the documents, or more generally records, satisfying the query; in the context of text retrieval, conjunctive queries are particularly common [8].

This requires a record-level index which indicates whether or not a record contains a word; indexes are word-level if word position is also stored. Second (2), must be possible to efficiently insert new records; because of the archival nature of most full-text applications, deletion and change are less common, but should still be supported. Last, given an informal query, it must be possible to statistically rank all of the records in the collection with respect to the query, so that the records most likely to be of interest to the user are retrieved first. This strategy simplifies the problem of finding text about a topic [8].

This full text database system applied the inverted indexes as a method in this research. A general inverted file index consists of two (2) parts which are a set of inverted file entries, being lists of identifiers of the records containing each indexed word and a search structure or vocabulary for identifying the location of the inverted file entry for each word refer to Figure 2.2. It have been assume that inverted file entries store ordinal record numbers rather than addresses, and so to map the resulting record identifiers to disc addresses there must also be an address table or disc mapping [8].
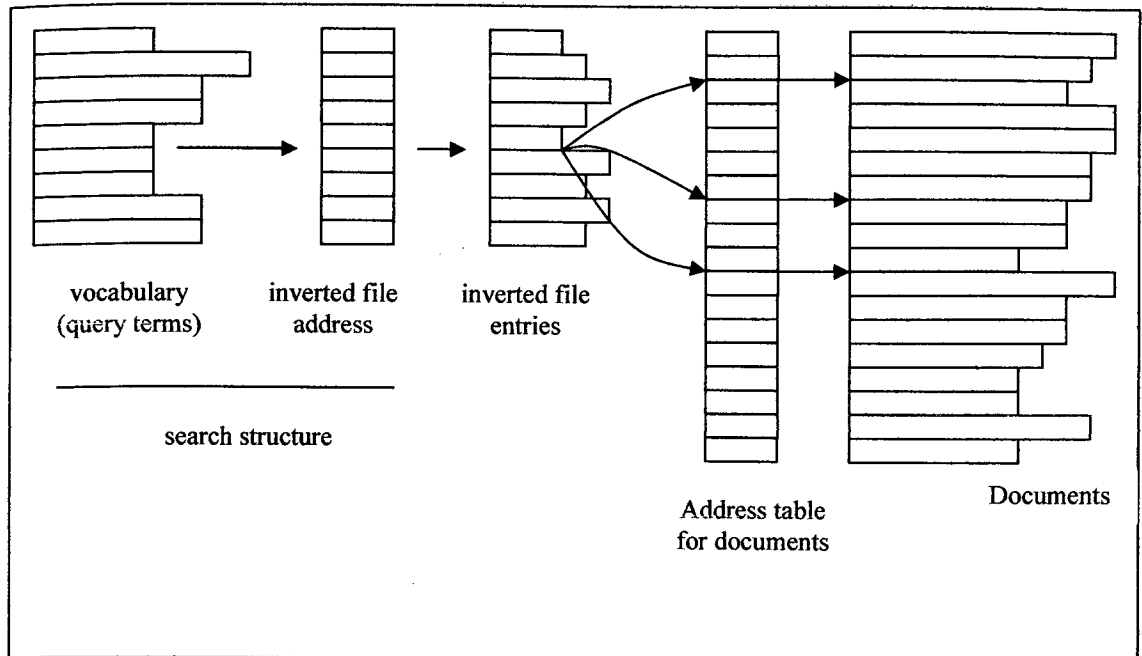
vocabulary
(query terms)

inverted file
address

inverted file
entries

search structure

Address table
for documents

Documents

Figure 2.2: Inverted File Index Structure

In a relational database, information about what indexes may potentially reference a given record can be determined easily from the definition of the index, due to the static nature of the scope of the index. In a hypertext system, determining what indexes a data item is in may be as difficult as building the index (in terms of number of items referenced). The use of back pointers is necessary to maintain the indexes at a reasonable cost when data items are modified [2].

2.4 Rule-Based System.

Rule-Based system is the structural form is consistent, the variables, comparators and rules have a given names which are meaningful to both the user and the developer and the sequence of condition testing which is always the same situation. Rule-Based systems are the shells of knowledge-based systems. By associating rules with database objects it becomes possible to build models and to apply those models to real world situations.