

**UNIVERSITY OF NAIROBI**

**SCHOOL OF COMPUTING AND INFORMATICS**

**BSC COMPUTER SCIENCE**

**PROJECT PROPOSAL**

**PROJECT TITLE: CASED BASED MEDICAL SUPPORT SYSTEM**

**By**

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# Abstract

In many domains Case-based Reasoning (CBR) has become a successful technique for knowledge-based systems. In medical domains, attempts to apply the complete CBR cycle are rather exceptional. Some systems have recently been developed, which on the one hand use only parts of the CBR method, mainly the retrieval, and on the other hand enrich the method by a generalisation step to fill the knowledge gap between the specificity of single cases and general rules. So, in this paper we discuss the appropriateness of CBR for medical knowledge-based systems, point out problems, limitations and possibilities how they can partly be overcome.

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# Chapter 1- Introduction

## Background

Medical diagnosis involves determining which disease or conditions explains a person’s symptoms and signs. This can be generally regarded as an attempt to classify an individual’s condition into separate and distinct categories that allow medical decisions about treatment and prognosis to be made. The information required for diagnosis maybe collected from a previous medical history if it’s available or a physical examination of the person seeking the medical care. Thereafter, a diagnosis is made, described in terms of a disease or other health conditions. However, in a case of a wrong diagnosis, the individual’s actual diseases or condition is not the same as the individual’s diagnosis.

Learning through experience is an important approach that humans employ to comprehend new problems. As a result they strive to augment their abilities by building tools. These tools extend the abilities of human beings to sense and to manipulate the world around them. Today, new technological developments which argument man’s reasoning have greatly been improved. Medicine is a field in which such tools are critically needed. The ever increasing need for highest quality health care and the rapid growth of ever more detailed medical knowledge leave the Doctor without adequate time to devote to each case and struggling to keep up with the newest developments in their fields.

Medicine plus artificial intelligence combine to form medicinal artificial intelligence. Its primary concerned with the construction of artificial intelligence programs that perform diagnosis and make therapeutic recommendations. It’s based purely on statistical and probabilistic methods. Medical AI programs are based on symbolic models of disease entities and their relationship to patient factors and clinical manifestations. Most medical decisions made by health care professionals must be based on rapid judgments to keep up with the newest developments in their field study, the number of patients they have to attend to and the number of cases they face each. Only in rare situations can a literature search or other extended investigation be undertaken to assure the doctor and the patient that the latest knowledge is brought to bear on any particular case.

The knowledge of physicians does not only consist of rules, but of a mixture of textbook knowledge and experience. Continued training and recertification procedures encourage the Doctor to keep more of the relevant information constantly in mind, but fundamental limitations of human memory and recall coupled with the growth of knowledge assure that most of what is known cannot be known by most individuals. Using CBR, a technique which solves a new problem by remembering a previous case and by reusing information and knowledge of that case, CBR turns that data into useful information that can help to make decision support systems for the diagnosis of infectious diseases.

The way a health care professionals diagnoses a disease it depends on their experience and knowledge on that specific disease under treatment. That way is similar to decision support system using CBR approach. CBR has four 4 phases which are retrieve, reuse, revise and retain. But in this system, only two phases are used that is retrieval and reuse techniques. Health professionals they analyze a patient through the outcome of critical factors (for example Blood pressure, Cholesterol level, Heart pulse ratings, vitals – temperature) and the feedback of queries during consultation. Feedbacks from the patient will be entered manually by Doctor during consultation. These values will be distributed to the doctor as well as CBR algorithm simultaneously. The algorithm analysis the values and recognizes both the case and solution. It is not only a recommendation system but also a patient profile reviewer.

## 2.1 Problem Statement

Medical diagnosis is often challenging, because many signs and symptoms are nonspecific, hence they don’t tell the healthcare professional what’s specifically wrong with the patient. General medical errors are like to occur such, over diagnosis, lag-time delay and diagnosis inconsistencies

Existing diagnostic approaches, such as differential diagnosis, pattern recognition, diagnostic criteria and use of a clinical decision support system are prominent parts of the current diagnosis procedures. All these methods present final results which may contain a list of possible conditions, ranked in order of probability or severity leaving the medical professional to make the final decision on the diagnosis.

There are existing CBR medical support system that are used in medical diagnosis, such as CASEY and FLORENCE. One of the major concern with some CBR systems is that they use generalization adaption to solve cases that are not similar. The systems combines both rule – based and case – based to solve the differences between cases. This combination is extremely lose.

An idea to avoid the adaptation problem is to build retrieval-only systems. These are programs that only retrieve similar cases and present them as information to the user. Some of them additionally point out important differences between current and similar cases.

The justification for giving up the adaptation task is that in some application domains it is much too complicated or even impossible to acquire adaptation knowledge and that physicians are interested to get information about former similar cases, but wish to reason for current patient themselves.

To better capture the patients’ disease we can use symptoms and signs exhibited by the patient and compare it with similar previous cases (with similar symptoms and signs) that have been treated successfully to offer medical diagnosis. This will reduce the medical errors and provide better medical care since the medical professional is treating the patients based on the analysis of millions of patients’ data and finding records that are actually similar to the patient’s symptoms and treating him/her in a much more accurate way.

## 1.3 Goal

## 1.4 Research Objectives

## 1.5 Project Objectives

1. To build a Cased Based Reasoning Medical Support system for the medical practitioners.
2. To create a complete system documenta

## 1.6 System Objectives

1. To assist health care professionals to make clinical decisions at the point of care by analyzing and reaching on a diagnosis based on previous successful cases.
2. To provide more consistent and objective medical treatment and storage of diagnosis over time.
3. To reduce time taken and cut cost incurred on over diagnosis, allowing medical professionals to see more patients.

## 1.5 Justification

Medical Support systems have the ability to scan a great deal of health-related parameters in a very short span of time, and greatly improves a practitioner’s ability to make decisions based off the readings provided – often in comparison to a baseline or healthy reading. With all this information at the disposal of a practitioner, one would expect significant improvement in patient results through the use of computerized medical diagnostic systems.

## 1.6 Limitation of Study

# Chapter 2 – Literature Review

## 2.1 Medical Diagnosis

Medical diagnosis it’s the process of determining which disease or condition explains a person’s symptoms and signs. The information required for diagnosis is collected from a medical history and physical examination of the person seeking the medical care. Medical diagnosis attempt to classify an individual’s condition into separate and distinct categories that allow medical decisions about treatment and prognosis to be made.

A medical diagnosis is often performed by various health care specialist such as physician, physical therapist, optometrist, healthcare scientist, chiropractor, dentist, podiatrist, nurse practitioner or physician assistance. These medical professionals use certain procedures to determine the disease or the condition the patient might be suffering from.

Diagnostics procedures include, detection of any deviation from what is normal such as anatomy, pathology, psychological and human homeostasis. A complaint as expressed by a patient. Complementing the already given information with further data gathering, a diagnostic test and processing the answers, findings are among the methods used to perform a diagnostic procedure.

A diagnostic procure my use a number of methods such as: differential diagnosis (finding as man candidate diseases or conditions as possible that can possibly cause the signs or symptoms followed by a process of elimination, ranking the final result in list of possible conditions, ranked in order of probability or severity.), Use of previous experiences to recognize a pattern of clinical characteristics (cognitive process based on the health care professionals experience), diagnostic criteria (designates the specific combination of signs, symptoms, and test results that the clinician uses to attempt to determine the correct diagnosis), and use of interactive computer programs designed to assist health professionals with decision-making tasks such clinical decision support system.

Wrong medical diagnosis may create adverse effects on the patient. Such errors include: over-diagnosis (involves diagnosing a condition or a presumed that will never cause symptoms or death during patient’s lifetime. Leads to economic waste and treatment my cause unnecessary harm to the patient), omission of a disease from consideration which may lead to harm to the patient, delay to deliver medical care if symptoms aren’t career to the health care professional.

## 2.2 Medical Records

Also referred as Health Records or Medical chart. These terms are used to describe the systematic documentation of single patient’s medical history and care across time. It includes a variety of details that are entered over time by health care professionals, recording observations, administration of drugs and therapies, the order of administration of drugs and therapies, test and results, and x-rays reports. Health care providers are required to maintain and record accurate records and it’s enforced as a licensing or certification prerequisite.

Medical records contain sensitive personal information hence, many ethical and legal issues are implicated in their maintenance such as third party access and appropriate storage and disposal. The information contained in the medical records allows healthcare providers to determine the patient’s medical history and provide informed care. Storage of medical records acts as a central repository for planning patient care, documenting and communication among patient and health care providers and professionals.

Traditionally, medical records were written on paper and maintained in folders often divided into sections for each patient, with new information added in the stored folder. But advances in technology in medical fields has led to introduction of Electronic Medical Records known as EMR. EMRS has made it easier to access files, safe keeping and maintain privacy of the stored information. Furthermore, it has led to increase research on how to use the EMRs to improve health care provision.

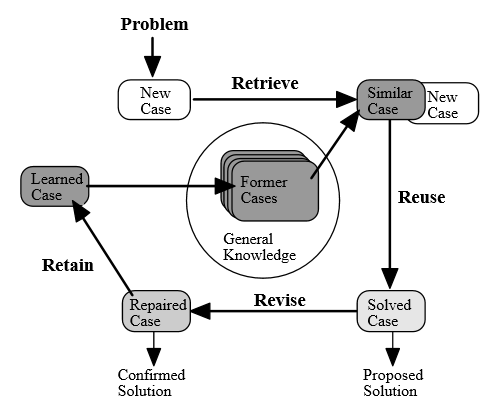
## 2.3 Medical history

Medical history is a gradual record of what has happened to the patients’ health since birth. It includes a historical record of diseases, major and minor illnesses, tests, diagnosis and drugs administered. It gives a clinician a feel for what has happened before to the patient. As a result, it may often give clues on the state of the current disease they are suffering from.

## 2.4 Cased Based Reasoning

CBR provides solutions for decision support systems to solve new problems. These solutions are based on similar past solutions. This means use of previous experience in form of cases to understand and solve new problems. A case-based reasoned remembers former cases similar to the current problem and attempts to modify their solutions to fit for the current cases. The underlying idea is that similar problems have similar solutions.

CBR consists of two main tasks: the first task is for retrieval. It’s used to search for similar cases stored in the master case. The second task, reuse and revision (Adaptation) which means a modification of solutions former similar cases to fit a current one.



## 2.5 Cased Based Reasoning for Diagnosis and Treatment.

Case-based reasoning (CBR) matches the natural reasoning model of a human. This approach is similar to that used by physicians when they are thinking: 'I have seen a patient like this', and provides instant recollection of past cases that may be relevant to the present case. In fact, CBR is an approach for solving problems based on solutions of similar past cases.

There are number of similar systems that uses cased base reasoning to aid in medical treatment. This include:

**CASEY**

It’s one of the earliest CBR systems developed for the diagnosis of heart failure. The working principal of the tool is matching a new case with the most similar stored cases, determining the difference levels, and then adapting the system based on the differences between the calculated and expected outcome. If the difference is tool large, it either retains the most approximate diagnostic decision with some explanation or ignore the given input and prompts for new inputs. It uses case-based domain logic and is able to handle the process of adaptation using some general operators. However, its major drawback is that it cannot tackle all cases types (complex cases with multiple attributes/features). If now similar case can be found or if all modification attempts fail, CASEY uses a rule-based domain theory.

**PSYXPERT**

It’s a diagnostic tool for psychiatric disorders. . Its domain knowledge is represented by production cases with backward chaining control structure for deriving suitable explanations related to each diagnosis. PSYXPERT has been implemented using Prolog. However, PSYXPERT is still unable to deﬁne a line between two very similar illnesses, which is a problem often encountered in psychiatric practice.

**FLORENCE**

It’s a system used to diagnose, prescribe, and determine the prognosis of the patients. It deals with health care planning in a broader sense, for nursing, which is less specialized field. A patient’s state of health is described in terms of some weighted values that are matched among the old and the new cases to find out the differences and an adaptations only made based on some acceptable differences. Such acceptability is dependent on the general knowledge of the nurses regarding the possibility of case’s health status in the ward. It lacks adaptability, which remains the main problem of this system, especially when the inputs are newer of the number of cases is large.

## System Architecture

# Chapter 3 - Methodology

## 3.1 System Analysis

### 3.1.1 Information Gathering

Information about the system should be gathered by reviewing existing systems, observations, interviewing a medical professional and reviewing records stored in the Electronic medical records.

### 3.1.2 Functional Requirements.

The system should be able to manage Users new users of the system to control access to the system. Since, the data stored on patient maybe confidential.

The system should be able produce reports that can be used to make decisions.

The system should be able to retrieve cases that are similar to the ones presented to it.

The system should be able update and add new cases in the system.

The system should be able to provide explanation on results presented to the medical professional.

### 3.1.3 Non – Functional Requirements.

User Interface – The system should provide a simple to understand interface that the users can be able to work.

Performance – The system is supposed to have a very short response time when retrieving cases or updating cases and producing reports.

The system should be secure enough to protect the privacy of the people using the system. Should provide an authentication, authorization and confidentiality of the information stored and the owners of the information stored.

## 3.2 Design

The system will be designed using RAD (Rapid Application Development) Development Methodology. RAD approaches emphasizes the necessity of adjusting requirements in reaction to knowledge gained as the project progresses. It also emphasizes on flexibility process that can adapt as the project evolves rather than rigorously defining specifications and plans correctly from the start. It acknowledges that software development is a knowledge intensive process and sought to develop flexible processes that could take advantage of knowledge gained over the life of the project and use that knowledge to reinvent the solution. Prototypes can be useable and can evolve into the completed product. One approach used in some RAD methods used are to build as series of prototypes that evolve from minimal functionality to moderately useful to the final completed system. Risk reduction as the prototype can be tested and this can be used to detect defects of the system early on in the life-cycle.

## 3.3 Test – Unit Testing

## 3.4 Evaluation – Acceptance Testing

# Chapter 4 - Project Management and Planning

## 4.1 Gant chart

## 4.2 List of Resources

## 4.3 Budget

# Conclusion

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# Appendix