



جمهورية العراق
وزارة التعليم العالي والبحث
العلمي
جامعة ديالى
كلية العلوم



ادارة مشاكل المشاريع الانشائية باستخدام نظام خبير مع خوارزميات PSO و GSA

رسالة مقدمة الى مجلس كلية العلوم/جامعة ديالى وهي جزء من
متطلبات نيل درجة الماجستير في علوم الحاسوب

تقدمت بها الطالبة
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CHAPTER ONE

INTRODUCTION

Chapter one

Introduction

1.1 An Overview

The expert system in the world of the artificial intelligence is a system in the computer that has the ability to imitator or repeats the intelligence jobs of human in the field on the decision making like the expert human skill do. The problems with sophisticated level can be solved as the system use information about their range of expertise. Thus the expert system will be designed depending on this information. In order that the system becomes an equivalent to the human thinking and uses data that is explicit in the field. The tools are used to gain such a type of information and the questions are asked to one or more experts. The artificial intelligence is the main area and the expert system consider sub-area. The applications in which this type of system used are geology, law, medicine, politics, chemistry, and economics. Every place or field that require to make a decision, the expert system may be used. (Adamus, S. U., 2018).

The simulation of the human expert is the base of the expert system which the latter use methods of inference for a convinced procedure of knowledge that is named domain and the methods that are used are knowledge, evidence, and reasoning, to resolve the issues that require the capability of a human skilled. The rules are used in the same manner as the human as a specialized human uses heuristically accomplished rules to find and troubleshoot the issues and flaws. (Ekhtiyarzadeh, D., & Radfar, R., 2015).

The problems in the construction industry are complicated as the construction projects time and resource are numerous and need much recourse like worker, budget, tools and technical needs .Also the constraints of the project like cost, time and quality and therefore lead to fail to gain the anticipated results of the project, therefore the project consider risky. So the management of the projects , problems are important for the success of the project. (Al-Zubaidi, E. A., Naji, H. I., & Ali, R. H.,2017).

1.2 Thesis Justification

In Iraq, construction projects face many problems as the most projects are being constructed in an unstable environment in term of cost and time and thus project management has been failing to meet the expectations of the owner and contractor both and that creates the need to build a system able to solve these problems.

The research justification can be explained as follows:

- 1- The size of construction projects and its complexity require the existence of an integrated system.
- 2- The unstable environment of the construction projects requires a system that able to make decisions without the loss of time and cost.
- 3- The cost and time of finding the best solution for the construction projects problems is high and therefore its required an integrated system.

1.3 Thesis Hypothesis

Based on the earlier justifications in the hypothesis is formulated as below:

There is a necessity to build an expert system to manage the problems in the construction projects that reduce the cost and the time of the project.

1.4 Thesis Aim and Objectives

The aim of this thesis is to build an expert system and consider an effective to manage the construction projects problems in term of both time and cost. Achieving current aim, there are some objectives must be obtained as follows:

- 1- Investigation and identification of the problems in construction projects.
- 2- Determining the effect of these problems on cost and time of the construction projects.
- 3- Find the solutions for these problems with effect on both cost and time
- 4- Build an expert system to manage these problems by using the techniques: particle swarm optimization and gravitational search algorithm.

1.5 Thesis Scope

Major projects in the Diyala governorate, especially university of Diyala university projects will be taken due to its significant budgets from periods 2006-2014 in addition to the projects of ministry of

education and ministry of construction and housing , the type of project were building and from the owner and contactor point of view.

1.6 Thesis Methodology

The methodology of the research is embraced that involves three parts:

Part 1-The Study of the Theoretical

A scientific literature review that deal with the following:

- 1- Expert system concept and its application in various sector and approaches in construction projects.
- 2- Reviewing cost and time problems, kinds, and factors that may affect the projects .
- 3- Reviewing the artificial intelligence techniques and the steps of its procedures and its uses in the construction projects

Part 2- Field Study

The field study involves the following:

- 1- **Open Questionnaire** This part comprises making many experts interviews. These comprise managers and professors of the university, and other projects parts in the following ministries: The Ministry of Construction and Housing, The Ministry of Higher Education and Scientific Research and Ministry of Education. The interviews are conducted as they have a significant part in aiding the later stage, also questionnaire discussion was firstly set from the literature and as well as some adjustments that made on the form to

add different question with the assistance of the experts to ensure the success of the method and questions presented.

- 2- **Closed Questionnaire:** when the interviews are completed with the experts, the research problems were separated into numerous groups which include, identification of the effect of the problem on time and cost, finding the solutions for these problems and finding the effect of each solution.

Part 3- Building an Expert System

The expert system was built as the following:

- 1- **Knowledge Base:** This step includes the collection of a of accurate and precise data, information and past experience that necessary for building the system which is based on the previous steps that mention in the field study .
- 1- **Inference Engine:** This part includes a collection of rules and efficient procedures In the situation of knowledge-based, the knowledge is been obtained and manipulated by the inference engine to get a specific solution.
- 2- **User Interface:** The interaction is offered by the user interface among the ES user and the ES itself.

The flowchart of the thesis in figure (1.1) which show the steps that will be followed in this thesis.

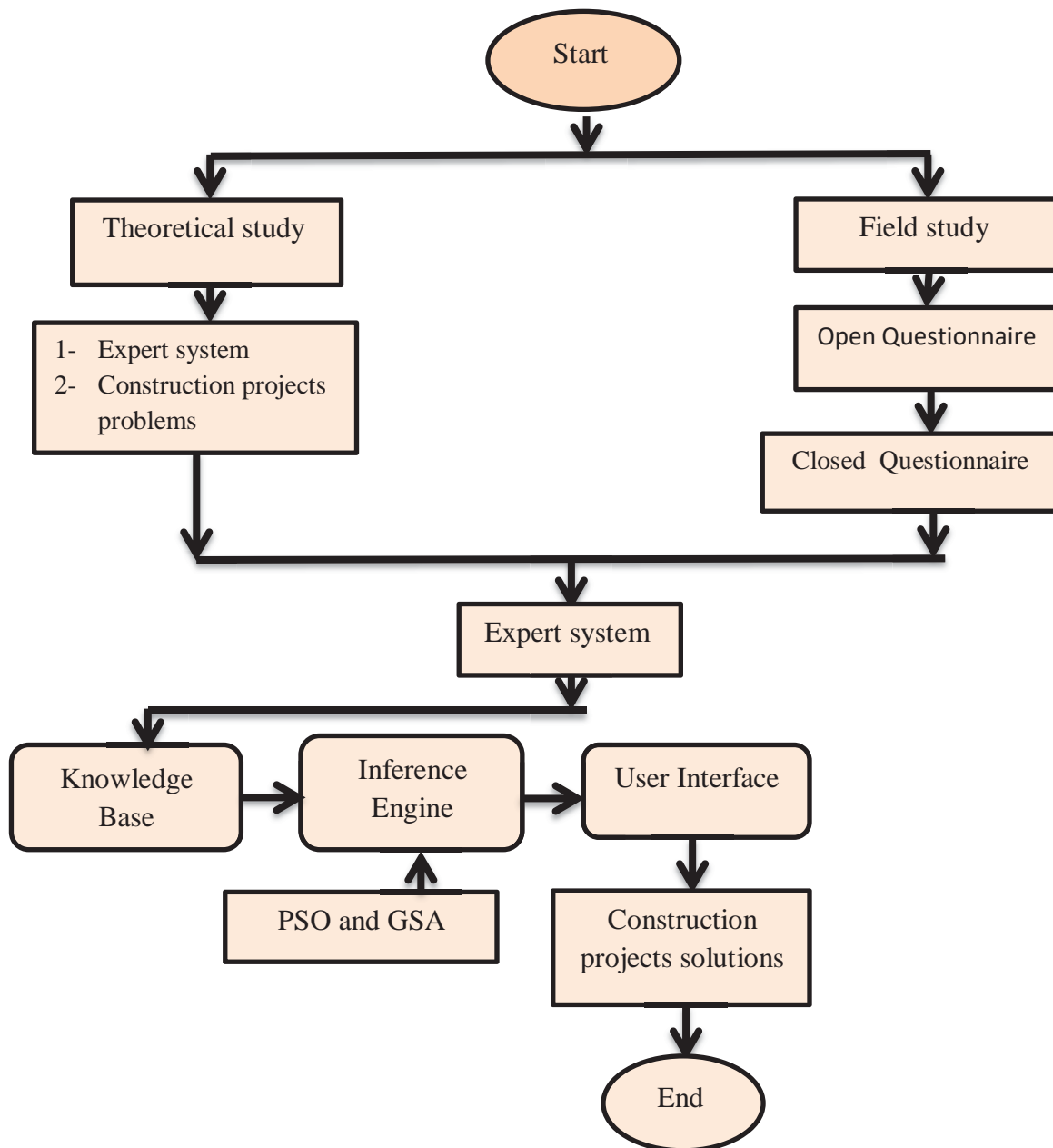


Figure (1.1) Methodology Flow Charts of the Research (Author)

1.7 Thesis Structure:

The research includes several chapters, which are:

Chapter One: This chapter includes a general introduction to the research, research problem, justifications, hypothesis, scope, research objectives, research methodology, the structure of the thesis and previous studies.

Chapter Two: This chapter deals with the projects definition, construction management, the stages adopted in the plan of action and its techniques. It also includes the time and cost problems and the techniques used to solve this problem.

Chapter Three: This chapter includes the data collection and how the data are been collected from the questionnaire and from the projects and its include various stages of the field survey. It includes the aspects related to the field questionnaire, the selection of the sample, the scheduling of the results obtained, the method of finding the qualitative assessment of the notification from the probability and impact calculation, and finally analyzing the results obtained from the field questionnaire.

Chapter Four: This chapter includes the steps in building the expert system and what's its elements and what each part of the system include.

Chapter Five: This chapter includes the results of the expert system and the results of PSO and GSA for pre and construction.

Chapter Six: This chapter contains a collection of the conclusions that gain by the researcher as well as recommendations and proposals for subsequent research.

1.8 Previous Studies

This section include several studies regarding the expert system in various field including construction and medicine to obtain a clear ideas of the studies in the fields of construction is little compared to other fields.

- 1- Z.A. Memon(2008): The author constructs ACPROM system that offers to back for the phase of investment implementation, the process of estimation the building progress works depending on project and documentation of the graphic, permitting to transfer the resultant databases to MS Project. It permits to combine: managerial drawings, digital images for the site of construction, photography of digital progress.
- 2- **M. Abdullahi, et al(2008)**: The author build COMIX which is an ES with rule and frame that offers recommendations on mixes of normal weight concrete design. This system was implemented by the engineers of concrete, engineers of design, and consultants. The system was built in New Zealand was Central Laboratories.
- 3- **Shaheen, A. A., Fayek (2009)**: Establishes how systems of fuzzy expert can be combined within models of discrete event simulation to improve their forming and capabilities of predictive for the applications of construction engineering. A suggested methodology is obtainable for information extracting from specialists to improve the rules of the fuzzy expert system. The produced fuzzy expert system is combined within the model of discrete event simulation to improve its capability of modeling by explicitly accounting for the various issues impacting certain activities simulation.
- 4- N. Ismail, et al(2009): The author , designed system for the evaluation of the pavement and rehabilitation as an instrument to support the engineers of the highway. Firstly, the system was established for the administration of the federal highway and the Illinois transportation department that offers sustained system support and development. The information is provided by the

well- informed and skilled pavement engineers to the system for the determination of the kind and overall reasons for pavement deterioration. Three kinds of the pavement are regarded by the expert system: (JRCP), (JPCP),(CRCP).

- 5- T. S. Sakthivel V. Kalyanaraman (2013): This paper Deliberates a KBES shell (IES) which combine different technologies of AI, that has the possibilities to execute new strategies for problem- solving needed for efficient handling of the entire process of engineering. Problems in the combined engineering process are firstly discussed, to progress a shell specification. The architecture blackboard is seen to be the perfect backbone for a shell-like this. The IES application is established using the combined engineering domain of steel industrial structures as an instance. This application includes the activities of engineering for conceptual design, comprehensive design, records, and construction planning.
- 6- Sadik, Ahmed Rabee (2013): This paper includes two stage, the first one is to execute a system for checking the web on PLC controlled production line prepared by FESTO and the purpose is teaching in TUT - Tampere University of Technology – FASTory lab facilities. The second one is built and execute a suitable.
- 7- P. Ziembicki, A(2013): The system has been built for the energy source selection at the University of Zielona Góra which has been produced in the research task No. 6 framework.
- 8- M. Akram, I.A. Rahman(2014): The Managers Advisory System platform is a prototype that is operational for the support of the decision for preparation and building projects management which can be used by managers of the building in their daily obligations

and through the phase of the pre-design. So far the program has been used to analyze small projects.

- 9- Davood Ekhtiyarzadeh and Reza Radfar (2015): They build and implement a system that can aid the professionals of the network or the users to solve problems. The system has the capacity and the ability to find the best solutions for the problems of internet communication that is completed by a full-time resident expert of human.
- 10- SAADU UMAR ADAMU (2018): The aim of this work is to provide a system for the diagnosis of malaria, the process of knowledge acquisition is done by conducting direct interviewing with the specialists in the medical field and the rule-based process is used to represent the knowledge. Whether the person is sick or not is been found by these rules, in addition, the kind of the disease like simple malaria, austere malaria is known. the software of the VP expert is used for the system and it was verified on 35 patients with accuracy about 93% and there was a comparison between the diagnosis of the specialists' and the advice.

The previous papers in the construction industry are either used an expert system alone to deal with problems or used only algorithms for the task of optimization or prediction in the field of roads or structural or civil engineering in general . In addition there are many papers that deals with problem in the construction without the use of any techniques to manage the problems .

Most of the papers deals with investigation , classification , identification and analyze of the problems without finding the solution for these problems.

The researcher in this thesis used an expert system with optimization algorithms which are practical swarm and gradational search algorithm in order not just identify the problems but analyze the projects in different phases and then find the problems in these phases and finally find the best solutions for these problems.

المستخلص

نظام الخبير في عالم الذكاء الاصطناعي هو نظام في الكمبيوتر لديه القدرة على تقليد أو تكرار وظائف الذكاء للإنسان في هذا المجال في عملية صنع القرار كما تفعل المهارة البشرية الخبيرة. يمكن حل مشاكل المستوى المتطور حيث يستخدم النظام معلومات حول نطاق خبرتهم. وبالتالي سيتم تصميم نظام الخبراء اعتماداً على هذه المعلومات. من أجل أن يصبح النظام مكافئاً للتفكير الإنساني ، فإنه يستخدم بيانات واضحة في هذا المجال

يهدف البحث إلى بناء نظام خبير يعتبر فعالاً في إدارة مشكلات مشاريع البناء من حيث الوقت والتكلفة من خلال بناء نظام خبير لإدارة هذه المشكلات باستخدام التقنيات: تحسين سرب الجسيمات وخوارزمية البحث عن الجاذبية.

لتحقيق الهدف من البحث ، تتضمن دراسة نظرية مراجعة الدراسات السابقة والدراسات الميدانية التي تتضمن استبياناً مفتوحاً ومغلقاً ، وأخيراً ، تم بناء نظام الخبراء.

أظهرت النتائج أن مرحلة البناء تعتبر مهمة للغاية ولها تأثير حوالي 25 ٪ على التكلفة و 20 ٪ في الوقت المحدد والترابط بين المشكلة متساوية تماماً في مشاكل البناء بدلاً من مشاكل ما قبل البناء.

يعتمد تصميم نظام الخبراء على تكوين المعرفة والحاجة إلى مشاريع البناء. تم تصميم هذا النظام لتوفير قاعدة بيانات للمشاكل السابقة التي حدثت في المشاريع. تُظهر خوارزمية PSO أداة فعالة في العثور على أفضل حل من حيث السرعة وطريقة البحث بينما GSA هي أيضاً أداة فعالة في إيجاد أفضل حل للمراهنة التي تتطلب المزيد من الوقت.

كل سرعة PSO تساوي صفراً بينما يكون GSA دائماً أكثر من الصفر مما يشير إلى أن PSO سريع وأيضاً في طريقة البحث كما هو موضح في المشكلة 8 و 9 تأخذ GSA طريقة مختلفة في إيجاد الحل.

التوصيات هي إجراء دورات تعليمية وتدريبية لتنفيذ نظام خبير في مشاريع البناء واستخدام نظام الخبراء في مشاكل مختلفة وفي مرحلة مختلفة ، وأخيراً اعتماداً على هذا النظام ، ابحث عن حلول للمشاكل المستقبلية.