ANT COLONY OPTIMIZATION FOR TOURIST ROUTE

A thesis submitted to the Faculty of Information Technology in partial Fulfillment of the requirements for the degree Master of Science (Information Technology) Universiti Utara Malaysia

By

Nopparat Meeplat

JABATAN HAL EHWAL AKADEMIK
(Department of Academic Affairs)
Universiti Utara Malaysia

PERAKUAN KERTAS KERJA PROJEK
(Certificate of Project Paper)

Saya, yang bertandatangan, memperakukan bahawa
(I, the undersigned, certify that)

NOPPARAT MEEPLAT

Calon untuk Ijazah
(candidate for the degree of **MSc.(IT)**

telah mengemukakan kertas projek yang bertajuk
(has presented his/her project paper of the following tile)

ANT COLONY OPTIMIZATION FOR TOURIST ROUTE

Seperti yang tercatat di muka surat tajuk dan kulit kertas projek
(as it appears on the title page and front cover of project paper)

Bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan.
(that the project paper acceptable in form and content, and that a satisfactory knowledge of the filed is covered by the project paper).

Name Penyelia Utama
(Name of Main Supervisor) : **PROF. DR. KU RUHANA KU MAHAMUD**

Tandatangan
(Name of Main Supervisor) :

Tarikh
(Date) : 22/8/05

PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a postgraduate degree from Universiti Utara Malaysia, I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purpose may be granted only by my supervisor or, in their absence by the Dean of the Faculty of Information Technology. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to University Utara Malaysia for any scholarly use which may be made of any material from my thesis.

Requests for permission to copy or to make other use of materials in this thesis, in whole or in part, should be addressed to

Dean of Faculty of Information Technology
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

ABSTRACT

Ant Colony Optimization is a relatively new meta-heuristic that has proven its quality and versatility on various combinatorial optimization problems such as the traveling salesman problem, the vehicle routing problem and the job shop scheduling problem. The inspiring source of ACO is the pheromone trail laying and following behavior of real ants, which use pheromones as a communication medium. In this project the ACO algorithm to routing problems in traveling cities under static and dynamic conditions. This study is divided into three parts. The first part aims to identify various connecting cities in Thailand with appropriate distances. The second part of this research involves formulating and applying the ACO algorithms to find the shortest path based on the distance calculated from source to destination cities. The ACO routing will then be applied on the constructed cities, taking into consideration different traffic conditions. The final part of the study focused on finding the shortest path and calculation of cost based on the distance traveled.

ACKNOWLEDGEMENT

With great humility, I am fully aware of my ability and strength to carry out this study through. I am greatly indebted to my supervisor Prof. Dr. Ku Ruhana Ku Mahamud for her generous counsel, constructive criticisms and also had labored endlessly in supervising me. To Mr. Alaa who contribute a valuable assistance and guidance without which the study could not be completed, I am truly grateful. Hence, I would also like to record my appreciation and gratitude to my family.

Lastly, I would like to acknowledge and thank everyone who is involved directly and indirectly in the completion of this study.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

Acronym	Meaning
AS	Ant System
ACO	Ant Colony Optimization
ACS	Ant Colony System
TTP	Traveling Tourist Problem
TSP	Traveling Salesman Problem
SOP	Sequential Ordering Problem

CHAPTER 1

INTRODUCTION

Ant Colony Optimization (ACO) is a new algorithmic framework useful for solving real time problem. This project introduces ant colony system (ACS), a distributed algorithm that applies to the traveling tourist problem (TTP). In this case, the best route to visit some places at Songkhla province in Thailand using ACS. In ACS, a set of cooperating agents called ants cooperate to find good solutions to the Traveling Salesman Problem (TSP). In this project it applies to TTP. We study ACS by running experiments to find the best solution for TTP and also to get good understanding of its operation.

The natural metaphor on which ant algorithms are based is that of ant colonies. Real ants are capable of finding the shortest path from a food source to their nest without using visual cues by exploiting pheromone information. While walking, ants deposit chemical substance called pheromone on the ground, and follow, in probability, pheromone previously deposited by other ants. Usually ant prefers to follow the path with high rate of pheromone. This way exploit the past of the search to find the shortest path between two points.

Ant algorithms were inspired by the observation of real ant colonies. Ants are social insects, that is, insects that live in colonies and whose behavior is directed more to the survival of the colony as a whole than to that of a single individual component of the colony. Social insects have captured the attention of many scientists because of the high structure of level their colonies can achieve, especially when compared to the relative simplicity of the colony's individuals. An important and interesting behavior of ant colonies is their foraging behavior, and, in particular, how ants can find shortest paths between food sources and their nest. Therefore, in this research, best route to be taken by the tourist can calculate using the ACS algorithm using Visual Basic language.

The contents of the thesis is for internal user only

REFERENCES

Dorogo, M., Maniezzo, V., & Colorni, A. (1991), "The Ant System: An Autocatalytic Optimizing Process" Technical Report No. 91-016 Revised, Politecnico di Milano, Italy.

Rigo, M., Maniezzo, V., & Colorni, A. (1996), "Ant System: Optimization by a colony of cooperating agents", IEEE Transactions on Systems, Man, and Cybernetics-Part B, 26(1), 29-41.

Dorigo M. & Gambardella L (1997), Ant Colonies for the Traveling Salesman Problem. BioSystems, 43, 73-81.

Blum C. & Roli A. (2003), "Metaheuristics in Combinatorial Optimization: Overview and Conceptual Comparisons". ACM Computimg Surveys, Vol. 35, No. 3. pp. 268-308.

N. Ascheuer (1995) "Hamiltonian path problems in the on-line optimization of flexible manufacturing systems".,Technische Universität Berlin, Germany

M. E. Bergen P.van Beek, T. Carchrae (2001) ,"Constraint-based assembly line sequenc-ing," Lecture Notes in Computer Science, 2056:88-99

Buckland, M., 2002, AI "Techniques for Game Developers", Premier Press, United States of America.

Dorigo ,M., & Gambardella, L. M (1997)" Ant colonies for the traveling salesman problem "BioSystems, 43 ,73-81

Jones, M., 2003, "AI Application Programming", Publisher: David Pallali. Reinelt, TSPLIB—"A traveling salesman problem library", ORSA J. Comput.3 (1991), 376-384.