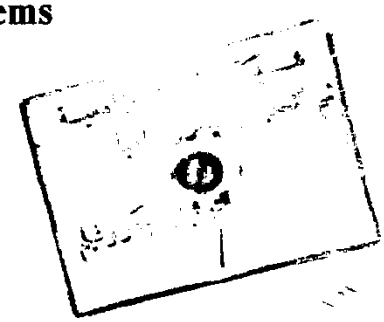
Ain Shams University
Faculty of Engineering
Public Works Department

Development and Modification of Techniques and Software for Preparing Digital Maps in an Appropriate Format for Conversion to Geographic Information Systems



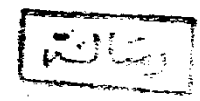
By
Amr Hosseiny Abd-Elrahman
B.Sc. Civil Engineering
Ain Shams University, 1990

A Thesis Submitted in Partial Fulfilment
for the Requirement of the Degree of
Master of Science in Civil Engineering
(Public Works Dept. - Surveying)

Supervised By

Prof. Dr. Mohamed M. Nassar
Professor of Surveying and Geodesy
Ain Shams University

Dr. Ibrahim F. Shaker
Lecturer of Surveying and Photogrammetry
Ain Shams University



CAIRO - EGYPT
1994

Ain Shams University
Faculty of Engineering
Public Works Department

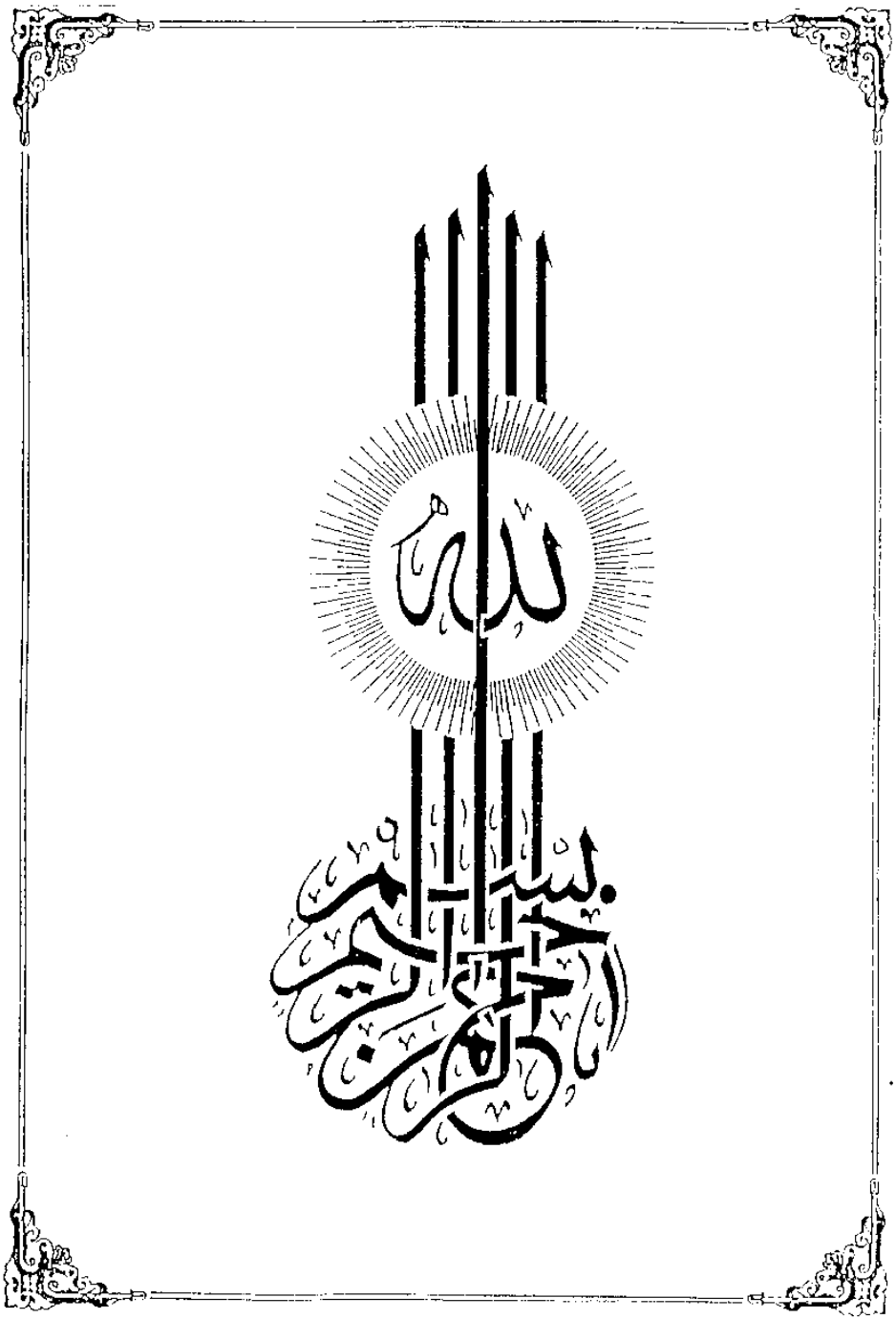
Approval Sheet

Development and Modification of Techniques and Software for Preparing Digital Maps in an Appropriate Format for Conversion to Geographic Information Systems

By
Amr Hosseiny Abd-Elrahman
B.Sc. Civil Engineering
Ain Shams University, 1990

This thesis for M.Sc. degree had been approved by :

Name	Signature
Prof. Dr. Mohamed S. Al-Gazali. Proffessor of Surveying and Photogrammetry Faculty of Engineering, Cairo University	
Prof. Dr. AbdelHadi S. AbdelAal. Professor of Surveying and Geodesy Faculty of Engineering, Ain Shams University	
Prof. Dr. Mohamed M. Nassar. Professor of Surveying and Geodesy Faculty of Engineering, Ain Shams University	



STATEMENT

The dissertation is submitted to Ain Shams University for the degree of Master of Science in Civil Engineering.

The work included in this thesis was carried out by the author in the Department of Public Works Ain Shams University from October, 1990 to December, 1994.

No part of this thesis has been submitted for a degree or a qualification of any other University Institution.

Date : / /1994

Name : Amr Hosseiny Abd-Elrahman

Signature :

ACKNOWLEDGMENTS

The author is greatly indebted to his supervisor Prof. Dr. Mohamed M. Nassar, Professor of Surveying and Geodesy, Public Works Department, Faculty of Engineering, Ain Shams University, for his invaluable support, encouragement and advice from which the author has continuously gained enthusiasm and confidence. I also wish to express my appreciation to him for the useful information I have obtained from his own library and for his concern and careful revision of the manuscripts of this thesis which immeasurably improved both the style and contents of the thesis. Therefore, I am indeed indebted to him and no words can adequate express my gratitude to him.

The author wishes to acknowledge his supervisor Dr. Ibrahim F. Shaker, Lecturer of Photogrammetry and Surveying, Public Works Department, Faculty of Engineering, Ain Shams University, who has helped in providing the concepts and the ideas which were developed in this thesis and under whose auspices the research work in this thesis was undertaken and achieved its objectives.

I would like to express my sincere gratitude to Dr. Osman Akif, Lecturer of Photogrammetry and Surveying, Public Works Department, Faculty of Engineering, Ain Shams University, for his great help during my first recognition with GIS; his valuable advice and encouragement during the development of the thesis; his concern and useful revision of the first draft of this thesis.

The development described in this thesis would not have been possible without the help and cooperation of a number of other individuals. Thanks must go first to Eng. Gamal Ibrahim, chairman of Cairo Engineering and Manufacturing Company, for providing the used data as well as some the software and hardware facilities. Special appreciation are extended to Eng. Wael Mansour at the GIS Department, Egyptian Surveying Authority and Eng. Hany Abd-El Mohsen at Cairo Engineering and Manufacturing Company who have been incredibly helpful in all consultations concerning the used GIS software and providing many GIS specialized technical papers, required data as well as some computational facilities.

Special thanks go to the other staff of the Cairo Engineering and Manufacturing Company with whom I stayed for about Six months getting all their cooperation and encouragement during the preparation of this thesis.

Last but not the least, I dedicate this thesis to my father, mother, grand mother and brother whose their prayers, support and encouragement have been a great help to me through this study.

Abstract

Geographic information systems (GIS) are the result of more than two decades of significant development in digital mapping and computer cartography. Recently, geographic information systems have become a hot topic among several users. Although computer processing has been applied to geographical problems for more than a quarter of century, it appears that there must be something different and more important about GIS that has caused so many diverse groups to invest so many resources. However, the process of building a geographic information system is not easy and requires highly professional skills. In addition, such process is usually faced with many problems that have to be handled in a certain way to get practical and economic solutions. Some of the most sophisticated problems encountered in this field are those concerning digital data conversion, as a geographic information data source, into geographic information systems. Such problems result from the significant differences in specifications and purposes between those two systems.

Accordingly, the current has been oriented towards solving some of the above problems in such a way to achieve the most economical, practical and simplest solutions accompanied with the hardly required software used to support and facilitate such solutions. More explicitly, problems investigated in this thesis can be distinguished as: the polygon features creation; the generation of features centerlines problems which do not, generally, exist in digital map data; the contour enhancement problems which include completion of stopped contour lines in steep areas and elimination of gaps within the contour features; and the separation of text information apart from spot heights digital map data. Each of these problems are solved providing certain developed software modules to support and facilitate the use of the suggested solutions.

In this context, a certain advantageous computer aided drafting system and its customizing facilities have been utilized in

developing the necessary for solving the above specific treated problems. Therefore, this developed technique can be efficiently used for any required preparations for digital map data, before they can be transferred to a specific geographic information system.

In order to ensure the reliability of the proposed solutions and their associated results and conclusions, a typical GIS pilot project has been investigated. Data handled through this investigation is a 1:5000 digital map data representing the base maps for certain area in a sister country lying in south west of Asia. The project basic requirements, specifications and all the practical steps for its execution are carefully analyzed. Two commercial software packages are used, the first is the AutoCAD software representing a popular computer aided drafting system and the second is ARC/INFO software which is a powerful specific geographic information system. Each of those two commercial packages requires different hardware configurations. Accordingly, two hardware platforms are used to support the two used software systems, the first platform is Personal Computers provided with high storage facilities and the other one is the very efficient and powerful DEC stations.

The obtained results from the present investigation have declared the advantages of the integration between the computer aided drafting systems as an inexpensive and simple software (and hardware) and the geographic information systems as actual specialized geographic information software (and hardware). This integration is very powerful specially when concerning digital map data preparation for geographic information systems. The proposed solutions yielding such integration have proved their reliability and practicality, from both time and storage viewpoints, through the flexibility of the two types of systems in particular when concerning their embedded programming languages and customized menus. Therefore, it is recommended to pay further attention to other problems, other than those investigated herein,

that may appear in digital map data preparation to GIS trying to perform some sophisticated GIS functions with much simpler computer aided drafting software. In addition,, it is recommended to consider the future application of the digital map data in GIS during the digital data capture stage, to facilitate the digital data conversion between the two systems.

TABLE OF CONTENTS

4. PRACTICAL SOLUTIONS FOR SOME SPECIFIC PROBLEMS RELATED TO DIGITAL DATA PREPARATION FOR GIS VIA THE DEVELOPMENT OF NECESSARY SOFTWARE MODULES

5. SUMMARY, CONCLUSIONS AND RECOMMENDATION

LIST OF TABLES

LIST OF FIGURES