Ain Shams University
Faculty of Engineering
Irrigation and Hydraulics Department

Development of a Geographic Information System Database for Modelling Irrigation Planning Distribution Systems In Egypt

By
Eng. Fayek Amin Farag
(B. SC. Civil Engineering - Ain Shams University)
Ministry of Public Works and Water Resources

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Supervised by

Prof. Dr. Mohammed El-Niazy Ali Hammad
Professor of Irrigation and Hydraulics Department
Faculty of Engineering, Ain Shams University

Prof. Dr. Mohammed Nour El-Din Auis
Professor of Irrigation and Hydraulics Department
Faculty of Engineering, Ain Shams University

Dr. Mounir Tewfik Selim
Assoc. Prof. of Public Works Department
Faculty of Engineering, Ain Shams University

Dr. Ibrahim F. Mohammed Shaker
Assoc. Prof. of Public Works Department
Faculty of Engineering, Ain Shams University

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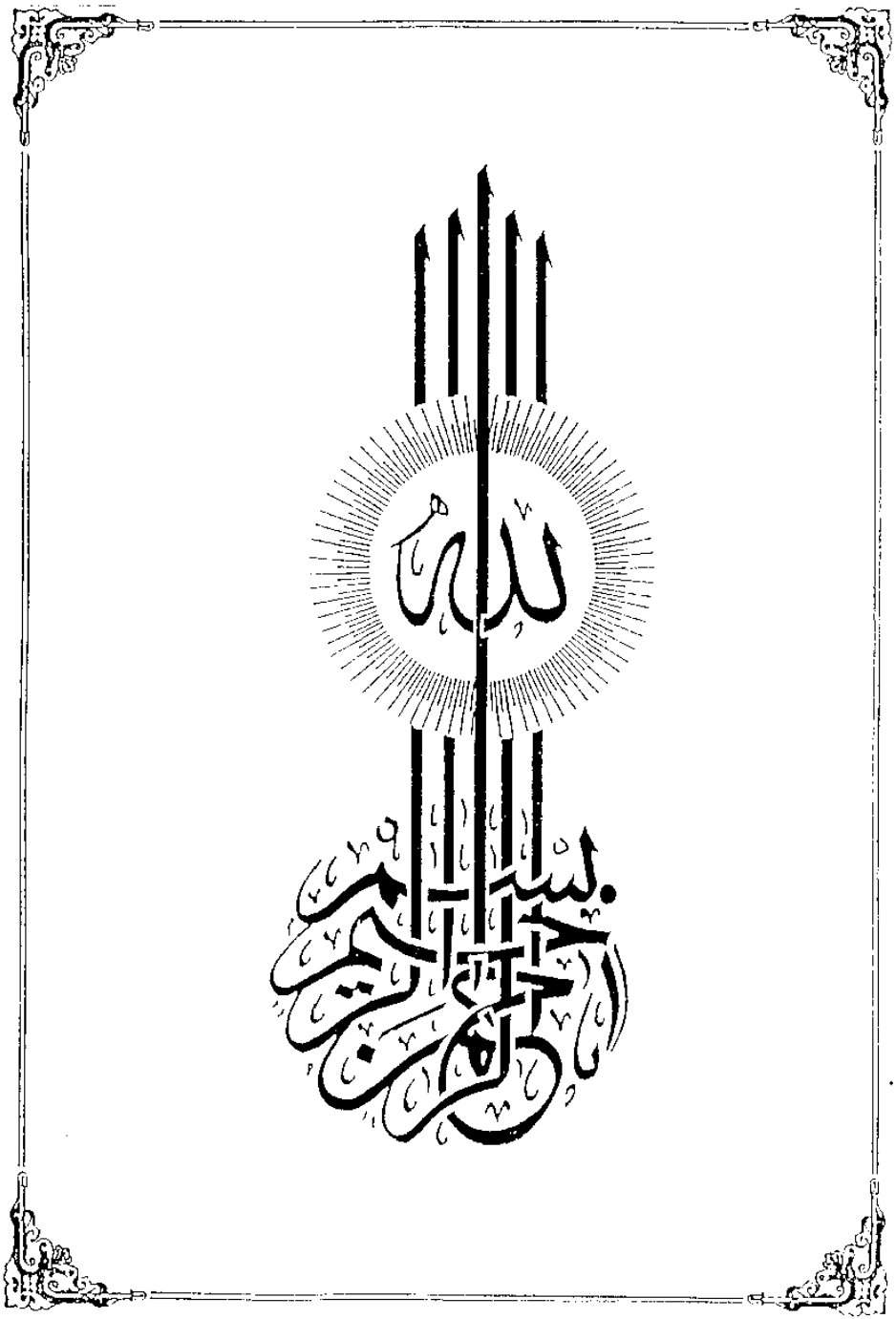

Approval Sheet

[ESIS: **Development of a Geographic Information System Database for Modelling Irrigation Planning Distribution Systems In Egypt**

': **Eng. Fayek Amin Farag**

;GREE: **Master of Science in Civil Engineering**

:AMINERS COMMITTEE:

Prof. Dr. **GAMAL SADEK EBAID**
Professor of Irrigation Design,
Irrigation and Hydraulics Department,
Faculty of Enginering, Ain Shams University

.....G. S. Ebaid.....

Prof. Dr. **TALAAT MOHAMED OWAIS**
Professor of Civil Engineering, Head of Water Engineering and Water Structures Department,
Faculty of Engineering, Zagazig University

.....

Prof. Dr. **Mohammed Nour El-Din AUIS**
Professor of Irrigation and Drainage,
Irrigation and Hydraulics Department,
Faculty of Engineering, Ain Shams University

.....

Dr. **IBRAHIM F. MOHAMED SHAKER**
Assoc. Prof. of Surveying and Photogrammetry,
Public Works Department,
Faculty of Engineering, Ain Shams University

.....

ıte:

STATEMENT

This thesis 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 Irrigation and Hydraulics, the Department of Public works, Ain Shams University and in the Ministry of Public Works and Water Resources from October, 1994 to April, 1997.

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

Date :

Name : Fayek Amin Farag

Signature : Fayek Amin Farag

VITA

Name	:	**Fayek Amin Farag**
Date of Birth	:	**December 6, 1963**
Scientific Degree	:	**B.Sc. in Civil Engineering** **(Public Works Department)** **With grade " Very Good"**
Graduated From	:	**Ain Shams University, Faculty of Engineering**
Date of Graduation	:	**July, 1986**
Current Job	:	**Team Leader of the Geographic Information Systems (GIS) unit, Planning Sector, Ministry of Public Works and Water Resources (MPWWR).**

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Abstract

The main objective of this thesis is: firstly, to show how to use satellite images to develop accurate base maps of the system of canals and drains in a pilot area. Secondly, the use of Geographic Information Systems (GIS) tools to construct the locational database based on the developed layout maps. Another objective of the study is to provide a link between the GIS database and the hydrologic models which are used in planning for the water policies in Egypt. The GIS database will be useful in the management of the irrigation and land reclamation projects.

The main required input data for the hydrologic models is a digital format for the layout of the canals and the drains systems of the study area, and a huge amount of data related to the models. This huge amount of data should be carefully organized in a database system in order to be able to analyze it efficiently.

The modern technology allowed the integration of remote sensing and Geographic Information Systems (GIS) to be applied for the management of the water resources data easily in a flexible and an accurate way. In order to obtain an accurate and up-to-date base maps of the pilot area, it is proposed to use the method of SPOT satellite images georectified with control points obtained with ground-based Global Positioning System (GPS). These images could be used for obtaining the canals and the drains system layout information as well as the command areas for the main canals and drains and other required spatial features. This unique method which is developed to obtain base maps from SPOT High Resolution Visible (HRV) satellite images using map coordinates obtained with Global Positioning System (GPS) is described in this thesis.

The thesis contains description of the major characteristics of the selected pilot area and a brief description of some models used for planning and management of the irrigation and drainage system. It reviews previous studies related to the applications of the GIS and Remote Sensing in similar situations. The thesis summarizes the use of GPS technology and the digital image processing. The thesis contains a detailed description of the development of the GIS Database and full explanation of all attributes and characteristics required to construct the database. Also, there is a description of entering and editing the data using different ways.

The main conclusion of the study is: the Geographic Information System (GIS) is the most simple and straightforward way of providing a management tool for planning of water allocation policy in Egypt. Besides it helps the decision makers in taking the right decision to solve the on-time problems dealing with the water polices without any delays. It allows also to make queries (What - If questions) to the database in order to extract an answer for the future planning under wide range of different scenarios.

The thesis recommends that the same framework can be used to expand and map other areas. The method of database expansion will be similar. The main difference in that framework will be the use and interpretation of 1:10000 orthophotoquads as base maps instead of georectified satellite images. The canals and drains system layout will be digitized on the maps by placing them on digitizing tables interfaced with PC ARC/INFO. The attribute GIS database will be a shell with empty slots for the different parameters of interest associated with the new spatial layout (i.e. canal hydraulic data, turnouts and control structures, ... etc).

Key Words: Geographic Information Systems (GIS), Remote Sensing, Global Positioning System (GPS), Water Resources Management, digital image processing, and the hydrologic models

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