Utilizing GIS for effective datamodel design at the NWU Potchefstroom Campus

D.A. Maree Hons. BSc.

20277725

Dissertation submitted in fulfilment of the requirements for the degree *Master of Science* at the Potchefstroom Campus of the North West University

Supervisor: Mr. T.C. De Klerk

November 2011

Potchefstroom

ABSTRACT

Record keeping and management of electrical utilities inside buildings is an important aspect to ensure effective electrical distribution. The ability to find the location of each electrical feature inside a building and extract information about it helps to solve network problems faster. The use of a spatial database structure facilitates the maintenance and general operations of an electrical network across different buildings.

The aim of this study is to design and develop a 3D data model to provide a management system for electrical utilities inside buildings. The geodatabase provides integrated information between different electrical components forming the network inside the specified buildings in the study area.

A prototype called the PUK geodatabase was designed and developed for the NWU Potchefstroom Campus as a 3D data model. The data model consists of raster and vector data used in network datasets, relationship classes and topology rules. The aim of this project was accomplished through the 3D analysis capabilities of the model. The research determined that the prototype called the PUK geodatabase can be utilized as a 3D management system for electrical utilities across the different floor levels of a building.

Keywords: 3D data model design, geodatabase design, electrical infrastructure management, network analysis, Potchefstroom campus.

OPSOMMING

Rekordhouding en bestuur van elektriese toebehore en infrastruktuur binne geboue speel ‘n belangrike rol om die effektiewe verspreiding van elektrisiteit te verseker. Die vermoë om die posisie van elke elektriese toestel binne ‘n gebou te bepaal en inligting daaroor te onttrek help om netwerk probleme vinniger op te los. Die gebruik van ‘n ruimtelike databasis struktuur fasiliteer die instandhouding en algemene bedrywighede van ‘n elektriese netwerk regoor verskillende geboue.

Die doel van hierdie studie is om ‘n 3D data model te ontwerp en te ontwikkel om sodoende ‘n bestuurstelsel vir elektriese toebehore binne geboue te verskaf. Die geografiese databasis verskaf geintegreerde inligting van verskillende elektriese komponente wat die netwerk binne die gespesifiseerde geboue in die studie-area vorm.

Die prototipe bekend as die PUK geografiese databasis was ontwerp en ontwikkel as ‘n 3D data model wat uit rooster en vektor data bestaan. Hierdie data word gebruik in netwerk datastelle, verhoudings en topologieë. Die doel van hierdie projek was bereik as gevolg van die model se vermoë om 3D analises te doen. Die navorsing het bepaal dat die prototipe bekend as die PUK geografiese databasis gebruik kan word as ‘n 3D bestuurstelsel vir elektriese toebehore regoor die verskillende vloer vlakke van ‘n gebou.

Sleutelwoorde: 3D data model ontwerp, geografiese databasis ontwerp, elektriese infrastruktuur bestuur, netwerk analise, Potchefstroom kampus.

ACKNOWLEDGEMENTS

During the course of my study I received encouragement and support from a variety of individuals whom I would like to thank in no particular order:

- To my Lord and Saviour, thank you for providing me with strength and perseverance throughout my studies. Without Your love and compassion, I would not have been able to achieve this.
- To my parents and my sister for their love, encouragement and support throughout my studies. Thank you for believing in me.
- To Yvette van Heerden, thank you for your love, support and encouragement throughout. You bring out the best in me.
- To my supervisor Mr. Theuns de Klerk, thank you for your commitment, patience, advice and constructive criticism. Without your support and guidance, this study would not have been possible.
- To my colleagues, Carl Bester and Armand du Toit for their moral support and encouragement. I will always be grateful.
- To Marnel Ferreira, for language editing and translation.
- To the personnel at the technical department of the Potchefstroom campus, especially Arno de Beer, for providing assistance and valuable information.
- To Lieb Venter for providing access and assistance to valuable information.
- To ESRI for providing ArcGIS10, ArcCatalog10 and ArcScene10 software that formed the basis for this project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES