DEVELOPMENT OF A KNOWLEDGE GRAPH MODEL FOR RESOURCE MANAGEMENT IN E-LIBRARY

AKINWUMI, HANNAH
18PCG02024
B.Sc Information Technology, Jamia Hamdard University, New Delhi

NOVEMBER, 2021

DEVELOPMENT OF A KNOWLEDGE GRAPH MODEL FOR RESOURCE MANAGEMENT IN E-LIBRARY

BY

AKINWUMI, HANNAH
18PCG02024
B.Sc Information Technology, Jamia Hamdard University, New Delhi

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES, COVENANT UNIVERSITY OTA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE IN COMPUTER SCIENCE

NOVEMBER, 2021

ACCEPTANCE

This is to attest that this dissertation was accepted in partial fulfillment of the requirements for the award of Master of Science (M.Sc) degree in Computer Science in the Department of Computer and Information Science, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria.

Mr. John A. Philip
(Secretary, School of Postgraduate Studies) _____ **Signature & Date**

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) _____ **Signature & Date**

DECLARATION

I, **AKINWUMI, HANNAH** with matriculation number **18PCG02024**, hereby declare that this dissertation entitled **DEVELOPMENT OF A KNOWLEDGE GRAPH MODEL FOR RESOURCE MANAGEMENT IN E-LIBRARY** was carried out by me under the supervision of Prof. Ambrose A. Azeta. This dissertation is an original study in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere.All scholarly information used in this study is fully acknowledged.

HANNAH AKINWUMI _____

Signature and Date

CERTIFICATION

This is to certify that the dissertation titled **"DEVELOPMENT OF A KNOWLEDGE GRAPH MODEL FOR RESOURCE MANAGEMENT IN E-LIBRARY"** was carried out by **AKINWUMI, HANNAH** with matriculation number **18PCG02024** under the supervision of Prof. Ambrose A. Azeta in the Department of Computer and Information Science, College of Science and Technology, Covenant University, Ota, Ogun State.

Prof. Ambrose A. Azeta ……..
(Supervisor) **Signature and Date**

Dr. Olufunke O. Oladipupo ……..
(Head of Department) **Signature and Date**

Prof. Olusegun Folorunso ……..
(External Examiner) **Signature and Date**

Prof. Akan B. Williams ……...
(Dean, School of Postgraduate Studies) **Signature and Date**

DEDICATION

This dissertation is dedicated to the Producer of the 'movie' of my life, the Ultimate Deliverer, the Way Maker, the Capable One, the King over all storms, the All Sufficient One, the Father of the fathers and the Father to the fatherless, the Great Provider, the Ever-loving One, the Never-erring but Forgiver of all sins, and the Timeless One that is always right on time - the Almighty God.

ACKNOWLEDGEMENTS

The Almighty God preserved, strengthened, and blessed me during this research work. He directed people to provide support to me during the course of this study. I give HIM all the glory.

My profound appreciation goes to the Chancellor and Chairman of the Board of Regents, Covenant University, Dr. David O. Oyedepo, for the academic and spiritual platform created. I sincerely thank the Vice-Chancellor, Professor Abiodun H. Adebayo and all the management team for running with the vision. I also appreciate the leadership of the School of Postgraduate Studies led by Professor Akan B. Williams and Dr. Emmanuel O. Amoo.

My heartfelt gratitude goes to my Supervisor, Professor Ambrose A. Azeta for his invaluable contributions, support, kindness, patience, understanding and his fatherly support, time, prayers and advice. Many thanks to Dr. Olufunke O. Oladipupo. (HoD, Computer and Information Science) for her advice and support towards the completion of my Master's degree programme. To my Postgraduate coordinator, Dr. Aderonke Oni, I want to say thank you for your timely words of encouragement and support even when I almost gave up and to all Faculty and Staff of Computer and Information Science Department, Covenant University for their support and encouragement at various times.
The scholarly contributions of Professor V.C. Osamor, Dr. Oyelade, Dr. I. Afolabi, Dr. I. Odunayo, Dr. S. Okuboyejo, Dr. Oluranti Jonathan and Dr. Falade to my dissertation are appreciated. May God satisfy all your heart desires, according to His perfect will.

Many thanks to my great parents, Sir and lady Peter D. Tuko (KSM, JP), for their sacrificial contributions to my basic and undergraduate education – which is the foundation on which my postgraduate education stands. My in-laws and my siblings especially Dr. Moses T. Tuko family, deserve commendation for their support to my family.

My sincere and heartfelt gratitude goes to my supportive husband of priceless value, best friend and "rabin rai", Dr. Isaac Ibukun Akinwumi, "Allah ya bar mu tare, ya kuma bamu yawanchi rai chikin kwanchiyar hankali da arziki". Thank you for your immense sacrifice,

prayers and understanding, especially when I was not readily available at home. To my children - Anna, Samuel and Elijah – thank you for sparing me part of the time I should have used to nurse and play with you.

I would also like to say a big thank you to all those, whose names I may have unintentionally omitted. God bless you all.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Electronic libraries grant communities access to electronic resources, aiding information seekers to acquire knowledge and utilize them for various purposes. The ambiguity of the natural language that makes it difficult to get a perfect match between a user's query and resources or document is an inherent challenge to any information retrieval system that deals with text. Techniques from information visualization like knowledge graph will be valuable to describe collections can optimize information retrieval services in several aspects such as recommendation and reference services. Some library users do not know how to search for the resources and materials they need. Some other categories of users come with only ideas to the library looking for resources. There are also case where librarians have to sources for materials to archive at the reference section of the library. This study provided a knowledge graph model of resources in E-library, boosted the information search and facilitated information retrieval more efficiently. This study collected dataset from an academic database and preprocessed after which the dataset was Transformed to Java Script Object Notation (JSON). The Resource Description Framework (RDF) modeled the data using turtle syntax to generate the schema. Entity and relationship was extracted with RDF Turtle syntax then the data was stored in MongoDB. The knowledge graph constructed by Coding Staple API GraphQL. The knowledge graph queried the graphQL and rendered knowledge graph via Vis.js. HTML, CSS and JS deployed for the front-end user access. The study utilized various technologies, such as MongoDB Atlas, Staple API and Repl.it IDE. A prototype knowledge graph was developed. A five-point Likert scale was used for the system's evaluation. The attributes evaluated were user satisfaction, efficiency and learnability. The average scores obtained for the user satisfaction, efficiency and learnability were 4.70, 4.21 and 3.71, respectively. The scores show that the users rated the system high.

Keywords: Electronic library, Electronic resources, Graphql, Knowledge graph, Ontology, Semantics.