ONTOLOGY AND LARGE LANGUAGE MODEL BASED INTELLIGENT TUTORING SYSTEM

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April 2024

DECLARATION

I declare that this is my own work, and this dissertation does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other University or Institute of higher learning, and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgment is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the Masters dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Dr. Thushari Silva

Signature of the Supervisor: Date: 25/04/2023

DEDICATION

This research is dedicated to diligent and dedicated tutors whose passion for education has illuminated the path of countless students, including myself. Your tireless efforts, patience, and commitment to nurturing intellectual curiosity have left an indelible mark on our academic journey.

ACKNOWLEDGMENT

I extend my deepest gratitude to my supervisor, Dr. Thushari Silva, for her unwavering guidance, invaluable insights, and continuous support throughout the research process. Her expertise and encouragement have been instrumental in shaping this thesis.

I am immensely thankful to the lecturers who imparted their knowledge and expertise during my academic journey at the University of Moratuwa. Their dedication, passion, and commitment to excellence have been instrumental in shaping my understanding of the subjects covered in this thesis.

I would like to express my appreciation to my family for their unconditional love, patience, and encouragement during this journey. Their unwavering support has been my source of strength and motivation.

Finally, I acknowledge the participants of this study for their valuable contributions, without which this research would not have been possible.

Thank you all for being part of this journey.

ABSTRACT

The evolution of online education systems traces back to distance education methodologies of the 18th and 19th centuries, which laid the foundation for independent learning. The late 20th century saw the convergence of technological breakthroughs, including personal computers and the internet, leading to the development of computer-assisted instruction (CAI) and later, learning management systems (LMS). Online education systems evolved to embrace asynchronous learning, multimedia capabilities, and social learning principles, experiencing further growth during the COVID-19 pandemic.

Prominent online learning platforms like Coursera, Udemy, and Skillshare have revolutionized access to education. these platforms have limitations regarding course quality consistency, instructor engagement, and accessibility. Artificial intelligence (AI) is transforming online education through Intelligent Tutoring Systems (ITS) and Expert Systems (ES). ITSs provide personalized and adaptive learning experiences, while ES assists with decision-making and problem-solving tasks. However, existing ITSs face limitations in scalability, automation, and feedback provision.

In this research, the hypothesis posits that an ITS can be developed effectively using Ontology and LLMs. This concept is inspired by the unique capabilities of Ontology in structuring human knowledge and LLM in possessing strong Natural Language Processing (NLP) capability and general knowledge.

The proposed system generates teaching plans, resources, assessments, quizzes, grades, progress tracking, and personalized feedback. Teaching plans outline schedules and topics, while resources enhance learning. Assessments and quizzes evaluate comprehension, with grades providing insights. Progress tracking identifies strengths and weaknesses, facilitating targeted interventions. Personalized feedback guides improvement strategies.

The system is divided into four main components which are the domain knowledge model, tutoring model, student model, and user interface. These components are designed to be segregated, allowing modifications to one component without affecting the others.

the evaluation of the system is done using the focused approach and comparative analysis. Using the focused approach find out if the combination of ontology and LLM is solving the issues that can't be solved by ontology and LLM working individually in the system. Using comparative analysis find out the system is better than the selected similar systems for the experiment.

TABLE OF CONTENTS

LIST OF FIGURES

Figure **Description** **Page**

LIST OF TABLES

Table **Description** **Page**

LIST OF ABBREVIATIONS

Abbreviation	Description
AI	Artificial Intelligence
ITS	Intelligent Tutoring System
LMS	Learning Management System
NLP	Natural Language Processing
CRS	Classroom Response System
CAI	Computer-Assisted Instruction
MOOC	Massive Open Online Course
ES	Expert Systems
RDF	Resource Description Framework
OWL	Web Ontology Language
GPT-3	Generative Pre-trained Transformer 3
SQL	Structured Query Language
RDBMS	Relational Database Management System
UI	User Interface
DOM	Document Object Model

LIST OF APPENDICES