A MODEL FOR SECURING E-EDUCATIONAL DATA FROM INSIDER THREATS USING BLOCKCHAIN TECHNOLOGY

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A THESIS SUBMITTED TO THE DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY (Ph.D) DEGREE IN COMPUTER SCIENCE, COLLEGE OF SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY, OTA, OGUN STATE, NIGERIA

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ACCEPTANCE

This is to attest that this thesis is accepted in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy in Computer Science in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Ogun State.

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DECLARATION

I, **UBAKA, MILLICENT NKIRUKA (15PCG01033),** hereby declare that this research was carried out by me under the supervision of Professor Ambrose A. Azeta and Dr. Aderonke A. Oni in the Department of Computer and Information Sciences, Covenant University, Ota. I attest that the thesis has not been presented either wholly or partly for the award of any degree elsewhere. All sources of data and scholarly information used in this thesis are duly acknowledged.

UBAKA, MILLICENT NKIRUKA

Signature and Date

CERTIFICATION

We certify that the thesis titled **"A MODEL FOR SECURING E-EDUCATIONAL DATA FROM INSIDER THREATS USING BLOCKCHAIN TECHNOLOGY"** is an original research work carried out by **UBAKA, MILLICENT NKIRUKA (15PCG01033),** in the Department of Computer and Information Sciences, Covenant University, Ota, Ogun State, Nigeria, under the supervision of Professor Ambrose A. Azeta and Dr. Aderonke A. Oni. We have examined and found the work acceptable for the award of the degree of Doctor of Philosophy in Computer Science.

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Prof. Akan B. Williams
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DEDICATION

I dedicate this research work to my Heavenly Father- The source of wisdom and in whom is no variation or shadow of turning. I also dedicate this work to my family Prince Chinedu Damian Ubaka and my children, Damian, Dominion, Daniel, and Joy Munachimso Damian-Ubaka. And to my parents, Chief & Mrs. Mike Okoye.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVATONS AND SYMBOLS

Acronyms	Full Meaning
App	Application
AWS	Amazon Web Service
API	Application Programming Interface
CSS	Cascading Style Sheets
CM	Consensus Mechanism
CS	Cryptographic Signature
CGPA	Cumulative Grade Point Average
CPD	Continuing Professional Development
DApp	Decentralized Application
DAO	Distributed Autonomous Organization
DAST	Dynamic Application Security Testing
DBA	Database Administrators
DHT	Distributed Hash Table
DLT	Distributed Ledger Technology
DNS	Domain Name System
HF	Hash Functions
HMM	Hidden Markov Model
HOD	Head of Department
HTML	Hyper Text Markup Language
HTTP	HyperText Transfer Protocol
IAST	Interactive Application Security Testing
ICTD	Information and Communication Technologies for Development
IDE	Integrated Development Environment
IPFS	Interplanetary File System
ISO	International Standardization Organization
JDBC	Java Database Connectivity
JSON	JavaScript Object Notation

JVM	Java Virtual Machine
LBC	Leader-Based Consensus
MIT	Massachusetts Institute of Technology
MOOC	Massively Open Online Course
NGO	Non-Governmental Organization
NOSQL	No Structured Query Language
N2N	Node to Node
PAI	Personality Assessment Inventory
POA	Proof of Authority
POS	Proof of Stake
POC	Proof of Concept
POZK	Proof of Zero Knowledge
PKI	Public key Infrastructure
PHP	Hyper Text Preprocessor
P2P	Peer to Peer
RASP	Runtime Application Self Protection
SaaS	Software as a Service
SAST	Static Application Security Testing
SDK	Software Development Kit
SUS	System Usability Scale
SQL	Structured Query Language
SVM	Support Vector Machine
TPS	Transaction Per Second
TSA	Trusted Authority
URL	Uniform Resource Locator
WAEC	West African Examination Council
WAMP	Windows Apache MySQL and PHP
XML	eXtended Markup Language

ABSTRACT

Personnel with authorization and system administrator's privileges to the institution's secret information or Internet protocol (IP) addresses are capable of causing internal threats. There is, therefore, the need for institutions to provide a protection mechanism towards detecting insider threats occurrence route. Educational data should be upheld with the utmost integrity. Insider threats have harmed large educational institutions such as national examination boards, amongst others. Furthermore, security concerns in standardized school examinations, like insider threat, has always been a major problem that is yet to be fully addressed in educational institutions. The objective of this research is to build a model using Blockchain technology to protect e-educational data against insider threats. The methodology and techniques engaged include Blockchain Technology, Trust Function Model, Asymmetric Cryptology Model, Netlogo Model App, Ethereum, Proof of Authority Front end implementation using JavaScript, MetaMask, Microsoft Visual Studio, MongoDB, Remix, and Ganache for the backend dashboard web application. The experimental findings indicate that Blockchain system rate of recurrence of insider threat is about 30% minimum when compared with the existing model that has 70%. The developed Blockchain model can handle up to one thousand operational transactions with ease to reduce insider threats.

Keywords: Blockchain Technology, Education Data, Data Security, Insider Threats, Online Network, Privacy, Proof of Authority (POA), Trust Model.