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Blockchain in Healthcare A Rigor Evaluation of Raising Demands and Challenges

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MS Thesis
In
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Blockchain in Healthcare A Rigor Evaluation of Raising Demands and Challenges

A Thesis Presented to

COMSATS Institute of Information Technology, Islamabad

In partial fulfilment
Of the requirement for the degree of

MS (CS)

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I Khurram Nissar, CIIT/FA20-RCS-023/LHR hereby declare that I have produced the work presented in this thesis, during the scheduled period of study. I also declare that I have not taken any material from any source except referred to wherever due that amount of plagiarism is within acceptable range. If a violation of HEC rules on research has occurred in this thesis, I shall be liable to punishable action under the plagiarism rules of the HEC.

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DEDICATION

This thesis is dedicated to my parents who always support me and motivate me. To all my family members who have never failed to give me financial and moral support. Finally, it is dedicated to all my friends who encourage me during the time of my research.

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ABSTRACT

Blockchain in Healthcare A Rigor Evaluation of Raising Demands and Challenges

Bitcoin was founded on the blockchain and has received massive attention latterly. Blockchain acts as an immovable ledger that enables transaction execution in a decentralized manner. As a matter of technological mutation, the blockchain is a novel database system. Instead of a single server or database, blockchain is based on technology that allows numerous copies of data to exist throughout a network. Because no centralized organization or establishment controls it, the stakeholder can access the identical version of the data in almost real-time. Decentralized databases, cryptography, and consensus algorithms are the driving force behind the next generation of the Internet. Data provenance, data integrity, data security, and data management can all be facilitated by blockchain's fundamental properties. Blockchain is now being researched for applications in a wide range of industries, including healthcare. The healthcare industry has several challenges, including incomplete data, medical histories that are fragmented throughout several healthcare facilities, and so on. It may require a blockchain-based strategy to improve it to a higher degree of functionality. Blockchain facilitates healthcare in better health record exchange, increased data security and privacy, trust in medical research, empowers the medical supply chain, and validates billing correctness.

The purpose of this research is to determine the decentralized feature of blockchain technology, which may be beneficial to the healthcare industry, as well as to describe existing implementations for the technology's use cases in the domain. This thesis underlines the internal functioning of blockchain technology in the healthcare industry as well as its potential application areas and existent solutions. Blockchain in healthcare applications will attract domains and individuals to refine their standard of living with trust, privacy, and reliability.

The method used is the systematic literature review. This study undertakes a review to comprehensively analyse and map the research area of current technologies, with a focus on the usage of blockchain in healthcare applications, into a cohesive taxonomy. The present review systematically searches all appropriate research papers on blockchain in healthcare applications in four attainable databases, IEEE and Web of Science, Scopus, and PubMed by using the specified keywords blockchain and healthcare and their variations. We accomplish a study selection procedure in four steps. The number of publications is reduced after each phase because undesired articles are excluded using search strings, inclusion, and exclusion criteria. We also did a study quality assessment, which aided us in analysing the quality of findings from the final collection of articles in answering the research questions.

According to the research questions, we summarized the findings from the 100 publications chosen throughout the study selection procedure. The prevailing research contributes to the literature by provisioning an extensive review of feasible substitutions and determining the research gaps.

Table 3.1 First Dataset Description

Attributes	Description	Values
1-Age	Patient Age	Age values
2-gender	Either patient is male or female	1-Male, 0=Female
3- CP	Chest-pain	1 = typ-ang, 2 = atyp-Ang, 3 = non-ang
4-trestbps	Blood-pressure in rest	BP values in rest
5-CHOL	Cholesterol	Cholesterol values
6-FBS	Blood Sugar	1 = present, 0 = Absent
7-restecg	Echocardiography at rest	1=Abnormal-ECG, 0=Normal
8-oldpeak	Exercise related to rest	Different values
9-slope	ST depression slope	0,1,2 represent different slopes
10-CA	Vessels	0,1,2,3 values represent how your arteries are affected
12- thalach	Patient maximum heart rate	Heart rate values
13-exang	Angina with exercise	1=present, 0=absent
14-target	Heart Disease	1= effected person, 0= healthy

Kaggle Dataset Description

This dataset obtains from Kaggle having 16 attributes and numeric values of each attribute instead of Binary values. Table 3.2 describe the detail description of every feature attribute of the dataset.

Table 3.2 Second Dataset Description

Attributes	**Description**	**Values**
1-Age	Patient Age	Age values between 34 & 77
2-Sex	Gender- Male/Female	1-Male, 0=Female
3-chol	Cholesterol level	Values b/w 129&189
4-Thalch	Maximum heart rate	Values b/w 88 & 195
5-oldpeak	Exercise related to rest	Values b/w 0 & 6.2
6-Platelets	Platelets in human body	Values b/w 12000 & 47000
7-sysBp	Systolic Blood pressure	Values b/w 120 & 180
8-diaBp	Diastolic Blood pressure	Values b/w 80 & 136
9-ST depression	Depression on ECG	Values b/w 0 % 6.2
10-BMI	Body MASS Index	Values b/w 17 & 45.7
11-Glucose	Glucose level in human	Values b/w 52 & 225
12- serum_sodium	Sodium level	Values b/w 116 & 145
13-serum_creatinine	Waste product in body	Values b/w 0.6 & 9.4
15-Smoking	Smoking of person	1=Yes, 0= NO
16-target	Heart Disease	1=Yes, 0= NO

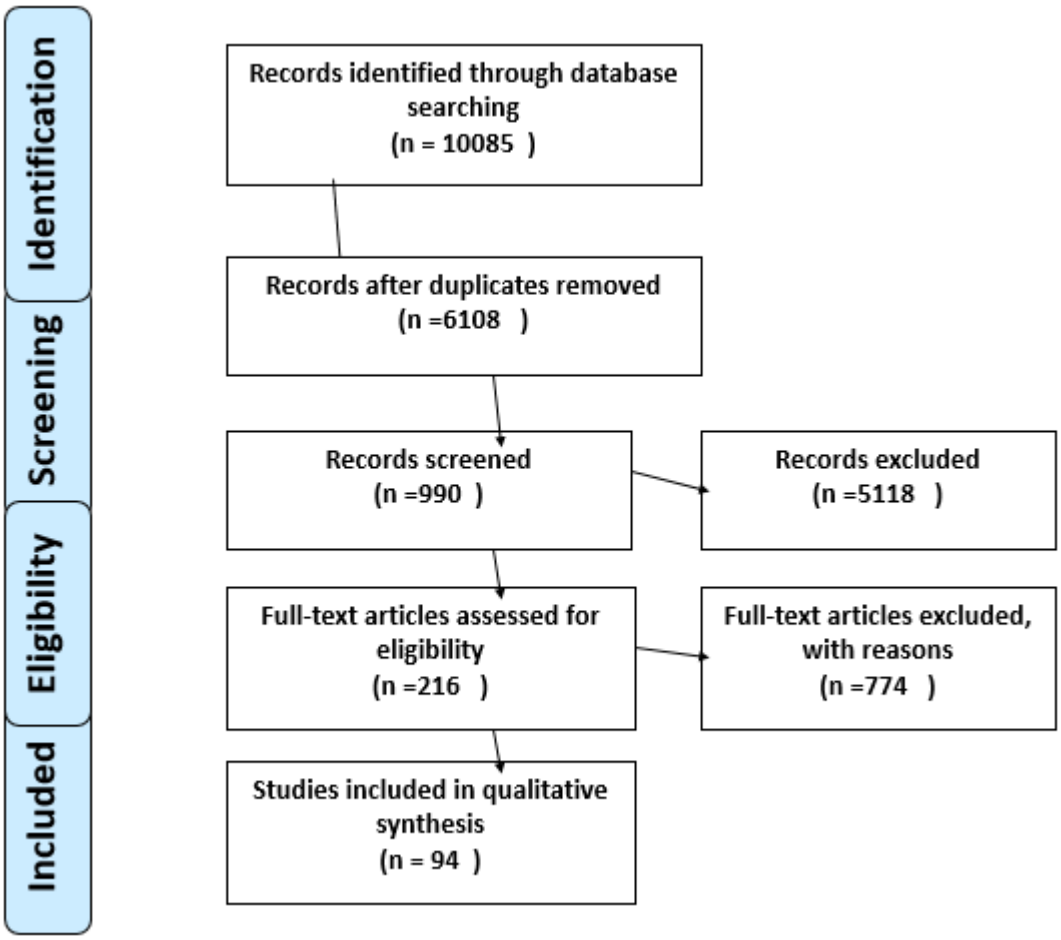

Figure 3.0:1 PRISMA chart for a systematic review of blockchain in healthcare

4.1 Following the above-mentioned search method, we go to the next stage of screening the articles obtained. In Step 1, the titles and abstracts are explored by applying the inclusion exclusion criteria. Among the acquired papers, those articles whose titles or abstracts Results comparisons of Machine learning classifiers withfeatures selection techniques on Kaggle dataset

Table 4.4 Results comparisons of Machine learning classifiers with features selection techniques on 2nd dataset

Machine learning Classifiers	Accuracy (%) with All features	Accuracy (%) with LASSO Technique	Accuracy (%) with MRMR technique	Accuracy (%) with MIFS Technique
SVM	81.32	81.96	82.72	82.13

Logistic regression	81.32	84.44	81.96	81.81
Naive Bayes	80.22	81.96	81.96	81.13
Decision tree	80.22	83.60	83.60	76.83
Random Forest	76.92	78.96	79.88	81.62
k- Nearest	82.42	83.60	83.60	84.49