

COMSATS UNIVERSITY

ISLAMABAD

SAHIWAL CAMPUS

**NAME:**

**HABIB UR REHMAN**

**REG NO:**

**CIIT-FA23-BS(CS)-251/SWL**

**SECTION:**

**E**

**SUBMITTED TO:**

**KHURRAM NISAAR**

#### First Lab Task and Assignment No 1



1. **Your Name**

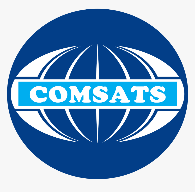
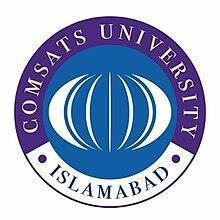
Roll Number

1. **Computer Science**

#### Submitted to

##### Khurram Nissar

Department of computer Science COMSATS University Islamabad, Sahiwal Campus



# Blockchain in Healthcare A Rigor Evaluation of Raising Demands and Challenges

*By*

Khurram Nissar CIIT/FA20-RCS-023/LHR

MS Thesis

In

‘‘Computer Science’’

COMSATS Institute of Information Technology

### Lahore - Pakistan Spring 2022

**COMSATS Institute of Information Technology**

## 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)

By

Khurram Nissar CIIT/FA20-RCS-023/LHR

Spring 2022

Blockchain in Healthcare A Rigor Evaluation of Raising Demands and Challenges



A Post Graduate Thesis submitted to the Department of Computer Science as partial fulfilment of the requirement for the award of Degree of M.S (CS).

|  |  |
| --- | --- |
| Name | Registration Number |
| Khurram Nissar | CIIT/FA20-RCS-023/LHR |

**Supervisor**

Dr. Abid Sohail Bhutta

Assistant Professor, Department of Computer Science COMSATS Institute of Information Technology (CIIT) Lahore Campus.

Submission Date: June, 2022

Final Approval

This thesis titled

## Blockchain in Healthcare A Rigor Evaluation of Raising Demands and Challenges

By

*Khurram Nissar CIIT/FA20-RCS-023/LHR*

Has been approved

For the COMSATS Institute of Information Technology, Lahore Campus

External Examiner:

Supervisor:

Dr. Abid Sohail Bhutta

Department of Computer Science/Lahore Campus Co-Supervisor:

Dr. Ashfaq

Department of Computer Science/Lahore Campus

HoD: Dr. Waqas Anwar

Department of Computer Science/Lahore Campus

**Declaration**

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.



Date: June, 2022 Signature of the student:

Khurram Nissar CIIT/FA20-RCS-023/LHR

**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.

###### ACKNOWLEDGEMENTS

First of all, I would like to thank Allah “Alhamdulillah” without whom nothing is possible, Who blessed me healthiest, capable, and consistent to complete the thesis effectively. I am nothing without the mercy of Allah (Jal e shan ho). I want to express my deepest appreciation to all those who provided me with the possibility to complete this thesis.

I would like to extend my gratitude to several people whose help was very valuable in this research. I would like to mention that my supervisor Dr.Abid Sohail For his meaningful assistance, tireless guidance, and patience have got successful.

I also like to thank my gratitude to co-supervisor Dr.Ashafq for sharing his pearls of wisdom with me during this research. I am also immensely grateful to all teachers of my institute who are for their comments on an earlier version of the manuscript, although any errors are my own and should not tarnish the reputations of these esteemed persons. I am very thankful to my loving parents for their love, support, prayers, and care about my health, which plays a vital role in my whole life.

**Khurram Nissar FA20-RCS-023**

#### 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 |

|  |
| --- |
| Identification Eligibility Screening Identification |



Record identified through database searching

(n+10085)

Record after duplicate removed

(n=6108)

Record excluded

(n=5118)

Record screened

(n=990)

Full-text article assessed for eligibility

(n=216)

Full text article excluded with reason

(n=774)

Studies included in qualitative synthesis

(n=94)

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 |

