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## SEC-HEALTH A BLOCKCHAIN-BASED PROTOCOL FOR SECURING HEALTH RECORDS

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### ABSTRACT

Storing and sharing health records through electronic systems pose security risks. To address them, several countries' regulations have established that healthcare information systems must fulfill security properties (confidentiality, access control, integrity, revocation and anonymity) and complementary ones (emergency access and interoperability). Upon tackling these issues, several proposals present security limitations and/or address specific properties only. We propose Sec-Health, a blockchain-based protocol that secures health records, addressing all of the main security and complementary properties defined in current regulations. We show that Sec-Health is a suitable solution by analyzing it under several attack scenarios and describing how it overcomes the problems of existing solutions. Furthermore, we evaluate a Sec-Health Proof of Concept, showing that it can reduce from 26% up to 90% the time to access health records, and reduce up to 50% client-side memory overhead, compared to related work.

### 1 INTRODUCTION

Information technologies introduce a number of resources and benefits to the healthcare field. Electronic Health Records (EHRs), such as patient's medical history, are one of the most widely employed resources [1], providing a wide view of a patient's medical status. EHRs are commonly originated and shared with collaborators (e.g., physicians, nurses) through cloud computing systems, which results in a more convenient approach to managing such records. Cloud-based systems, however, introduce security challenges in healthcare [2]. A recent report shows that healthcare data breaches are highly common [3], wherein several of them are classed as unauthorized access, which may lead to inappropriate use of health records (e.g., unwanted advertisements or lower chances of conquering a job opportunity).

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### Literature Survey

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A literature survey for a project titled "A Blockchain-Based Protocol for Securing Health Records" would typically involve gathering and reviewing relevant academic papers, articles, and other sources that discuss various aspects related to blockchain technology and its application in securing health records. Here's a structured approach to conducting such a literature survey:

### **3 IMPLEMENTATION STUDY**

#### **EXISTING SYSTEM:**

The literature presents several proposals that aim to ensure health records security. However, there is a lack of proposals that approach the main health records properties. Instead, they address only a subset of the concerns [2]. In general, these solutions employ centralized approaches (e.g., based on clouds) or decentralized ones (e.g., blockchain-based). To delineate a state-of-the-art overview, we now present security proposals for health records. Ganiga et al. [6] elaborated a healthcare security framework for cloud-based systems, which addresses confidentiality and access control by employing attribute-based encryption.

#### **Disadvantages:**

There is no MECHANISMS FOR ACCESS REVOCATION AND INTEROPERABILITY system which is not in an existing system.

There is no health records protection against unauthorized modification and deletion.

#### **Proposed System & algorithm**

The system proposed Sec-Health, a protocol that secures health records by addressing all of their properties. In essence, Sec-Health is composed of a set of schemes, based on decentralized approaches (e.g., blockchain and Inter Planetary File System [10]) and cryptographic primitives (e.g., Ciphertext-Policy Attribute-based Encryption [11] and public key encryption), which allow records to be stored and shared securely. Sec-Health fills the gap of the literature that lacks integrated approaches which fulfill all health records properties. It overcomes the security problems of proposals based on centralized servers and presents advantages over other decentralized solutions by covering not only the most addressed properties of health records (confidentiality, access control, and integrity), but also more challenging ones (e.g., emergency access, access revocation, and anonymity).

#### **4.1 Advantages:**

- a blockchain-based protocol (Sec-Health), based on our previous work [12], which enhances the schemes employed in the previous protocol to fulfill the security properties of confidentiality, access control, and integrity;
- (ii) Sec-Health includes novel schemes to address additional properties, i.e., emergency access, access revocation, anonymity, and interoperability;

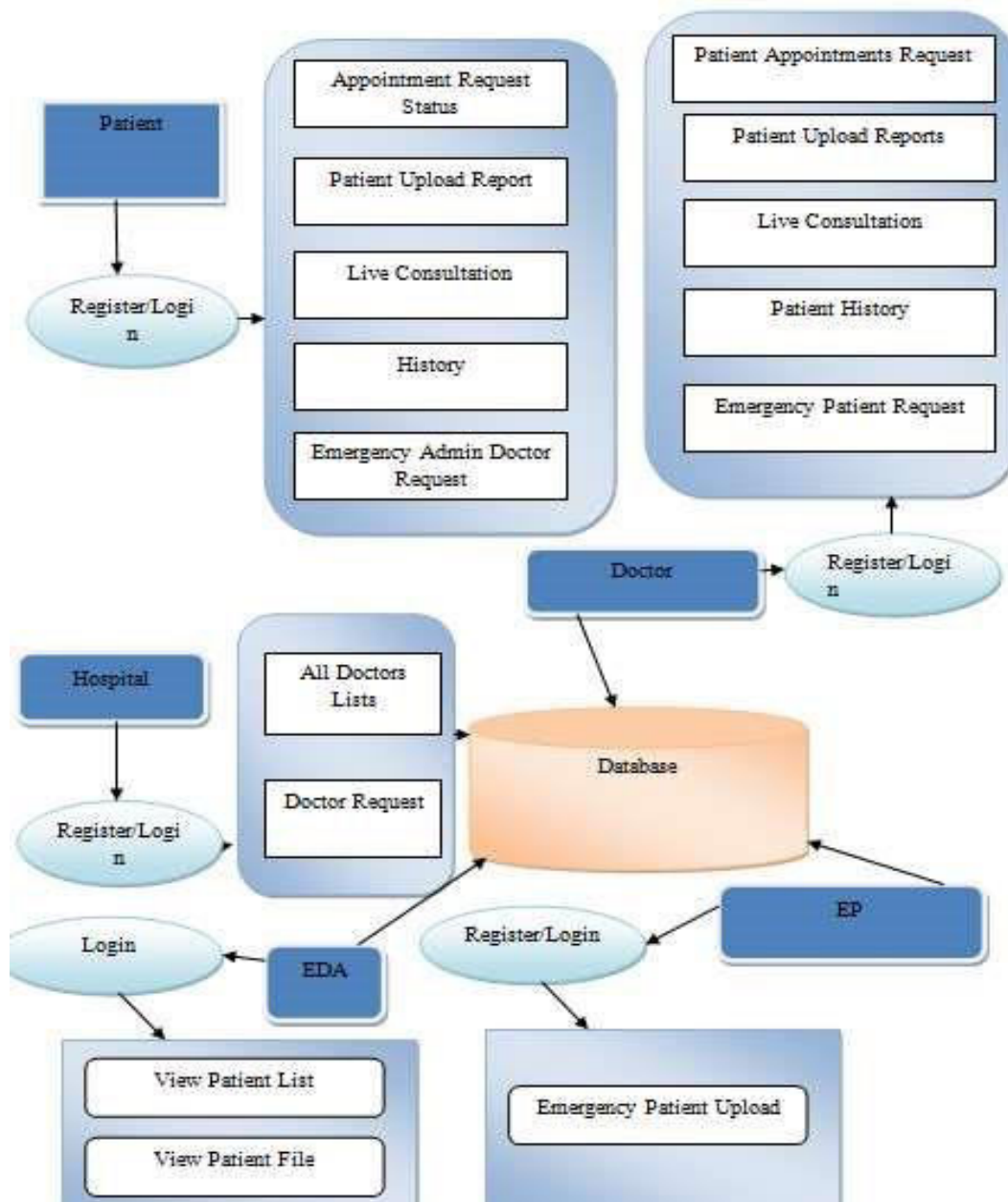


Fig:3.1 System Architecture

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## IMPLEMENTATION

### Modules

#### Admin

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as Login, List all users and authorize, View All Datasets, Decrypt & View All Health Records Type By Block chain, View Healthcare Records Type Results, View Diets Records Type Results.

#### View and Authorize Users

In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

#### User

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like Register and Login, View Profile, Upload Datasets, Find Healthcare Record Type, Find Healthcare Record Type By Hash code.

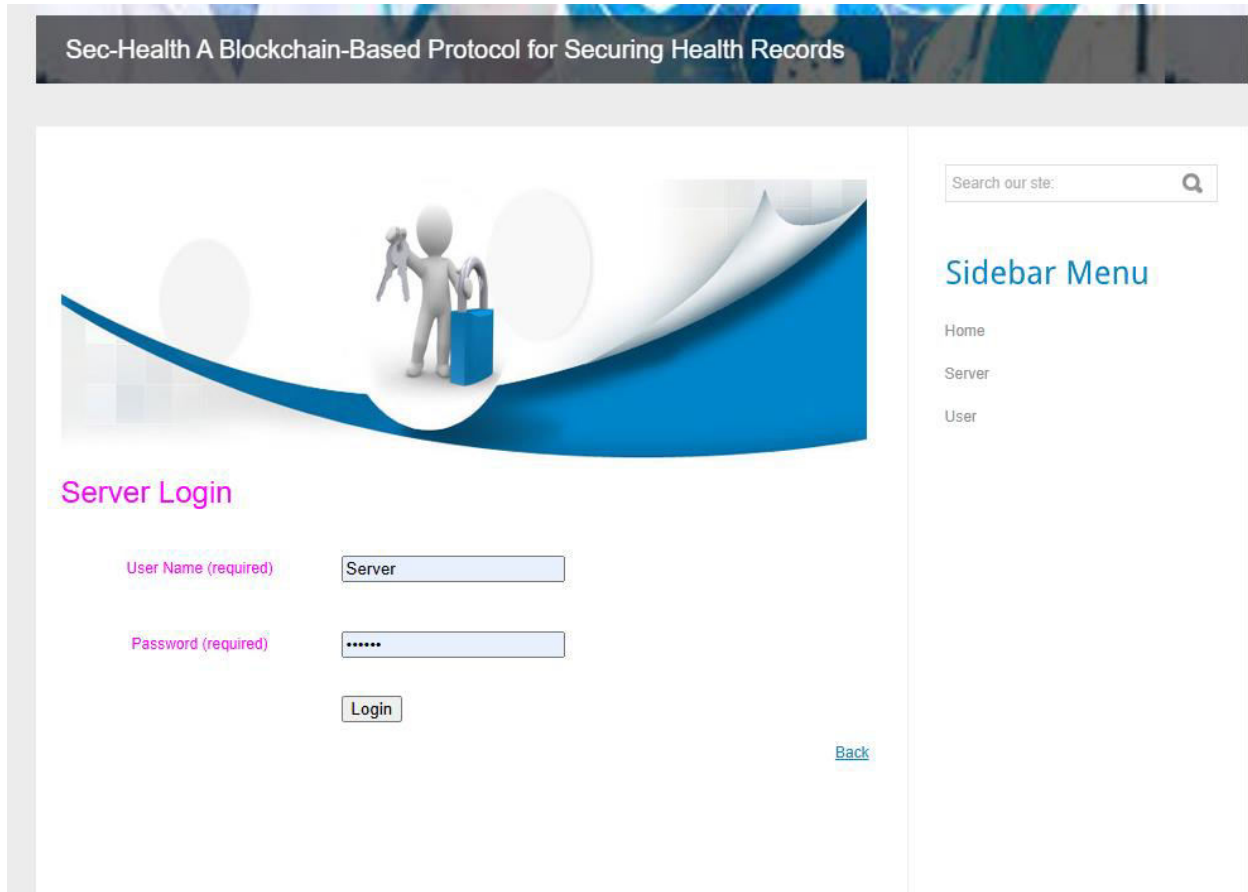
## 5 RESULTS AND DISCUSSION

### Screen Shots :





### 5.3.1 LOGIN PAGE







**Fig 5.1 LOGIN PAGE**

### 5.3.2 VIEW AND AUTHORIZE USERS

Sec-Health A Blockchain-Based Protocol for Securing Health Records

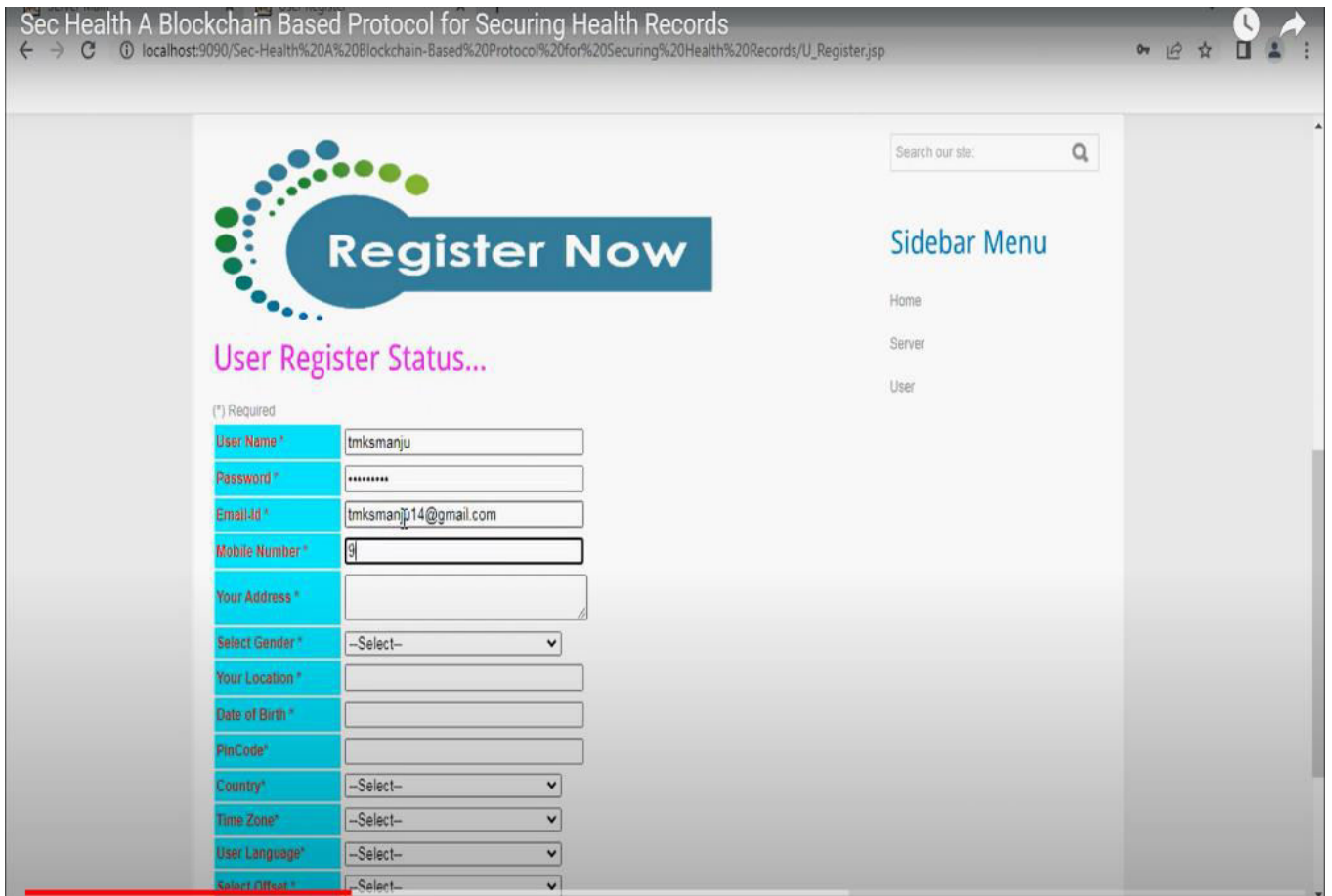
#### View and Authorize Users..

ID	User Image	User Name	Email	Mobile	Location	Country	Status
1		Kumaran	Kumaran123@gmail.com	9535866270	Bangalore	India	Authorized
2		Manjunath	tmksmanju14@gmail.com	9535866270	Bangalore	India	Authorized
3		tmksmanju	tmksmanju14@gmail.com	9535866270	Bangalore	India	Authorized
4		raj	aa@aa.com	9347225321	vskp	India	Authorized

[Back](#)

Fig 5.2 VIEW AND AUTHORIZE USERS

### 5.3.3 REGISTER PAGE



### 5.3 REGISTER PAGE



**5.3.4 DATA PAGE:**



View All Datasets !!!

Patient_ID	Age	Sex	Cholesterol	Blood_Pressure	Heart_Rate	Diabetes	Family_History
203.205.179.170-10.42.0.211-80-45697-6	NjcuMA==	TWFsZQ==	MjA4LjA=	MTU4Lzg4	NzfuMA==	MC4w	0.0
10.42.0.211-98.139.199.204-52206-443-6	MjEuMA==	TWFsZQ==	Mzg5LjA=	MTY1Lzkz	OTguMA==	MS4w	1.0
10.42.0.42-64.71.142.95-60947-443-6	MjEuMA==	RmVtYWxl	MzI0LjA=	MTc0Lzk5	NzfuMA==	MS4w	0.0
209.10.120.26-10.42.0.211-80-34498-6	ODQuMA==	TWFsZQ==	MzgzLjA=	MTYzLzEwMA==	NzMuMA==	MS4w	1.0
10.42.0.211-88.212.201.195-50418-443-6	NjYuMA==	TWFsZQ==	MzE4LjA=	OTEvODg=	OTMuMA==	MS4w	1.0
10.42.0.211-104.192.110.245-54035-80-6	NTQuMA==	RmVtYWxl	Mjk3LjA=	MTcyLzg2	NDguMA==	MS4w	1.0
10.42.0.211-10.42.0.1.45098	OTAuMA==	TWFsZQ==	MzI0LjA=	MTA4Lzg2	ODQuMA==	MC4w	0.0

**Fig 5.4 DATA PAGE**

**5.3.5 BLOCK CHAIN:**



**Fig 5.5**

**View All Datasets By Blockchain !!!**

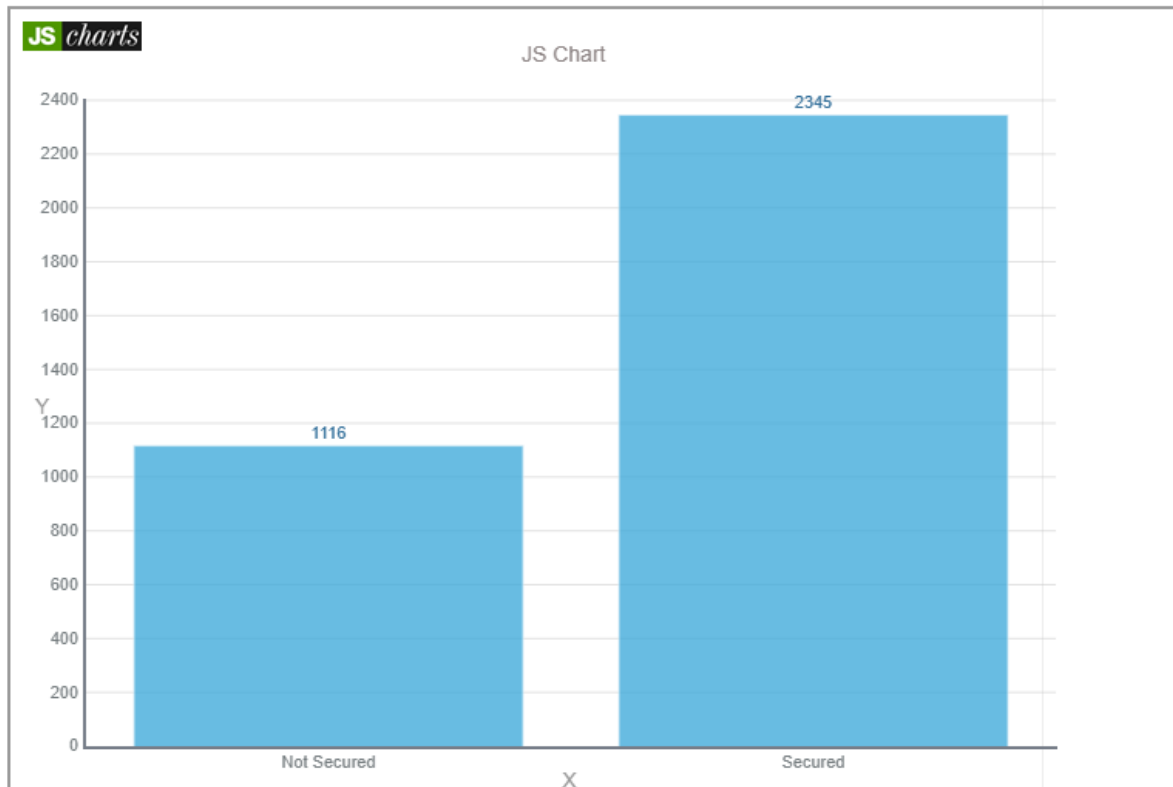
**Health Records Type Block Chain-->:: Secured**  
**Health Records Type Hash Code ---->::6ae9dc460b49c2aaf6337dd9c775109e60c5a4cd**

Patient_ID	Age	Sex	Cholesterol	Blood_Pressure	Heart_Rate	Diabetes	Family_History	Smoking	Obesity	Alcohol_Consumpti
203.205.179.170-10.42.0.211-80-45697-6	67.0	67.0	Male	208.0	158/88	72.0	0.0	1.0	0.0	0.0
209.10.120.26-10.42.0.211-80-34498-6	84.0	84.0	Male	383.0	163/100	73.0	1.0	1.0	0.0	1.0
10.42.0.211-104.192.110.245-54035-80-6	54.0	54.0	Female	297.0	172/86	48.0	1.0	1.0	0.0	1.0
10.42.0.151-23.194.181.192-45017-443-6	84.0	84.0	Male	220.0	131/68	107.0	0.0	1.0	1.0	1.0
10.42.0.151-10.42.0.1-7610-53-17	43.0	43.0	Female	248.0	160/70	55.0	0.0	1.0	1.0	1.0
10.42.0.42-123.125.29.220-48865-80-6	71.0	71.0	Male	374.0	158/71	70.0	1.0	1.0	1.0	1.0
10.42.0.42-111.206.25.159-46340-80-6	77.0	77.0	Male	228.0	101/72	68.0	1.0	1.0	1.0	1.0
162.208.20.184-10.42.0.151-443-	60.0	60.0	Male	259.0	169/72	85.0	1.0	1.0	0.0	1.0

**BLOCKCHAIN**

### 5.3.6 VIEW HEALTH CARE RECORD

## View Healthcare Records Type Results !!!



**Fig 5.6 VIEW HEALTH RECORDS TYPE RESULTS**

### 5.3.7 VIEW DIETS RECORDS

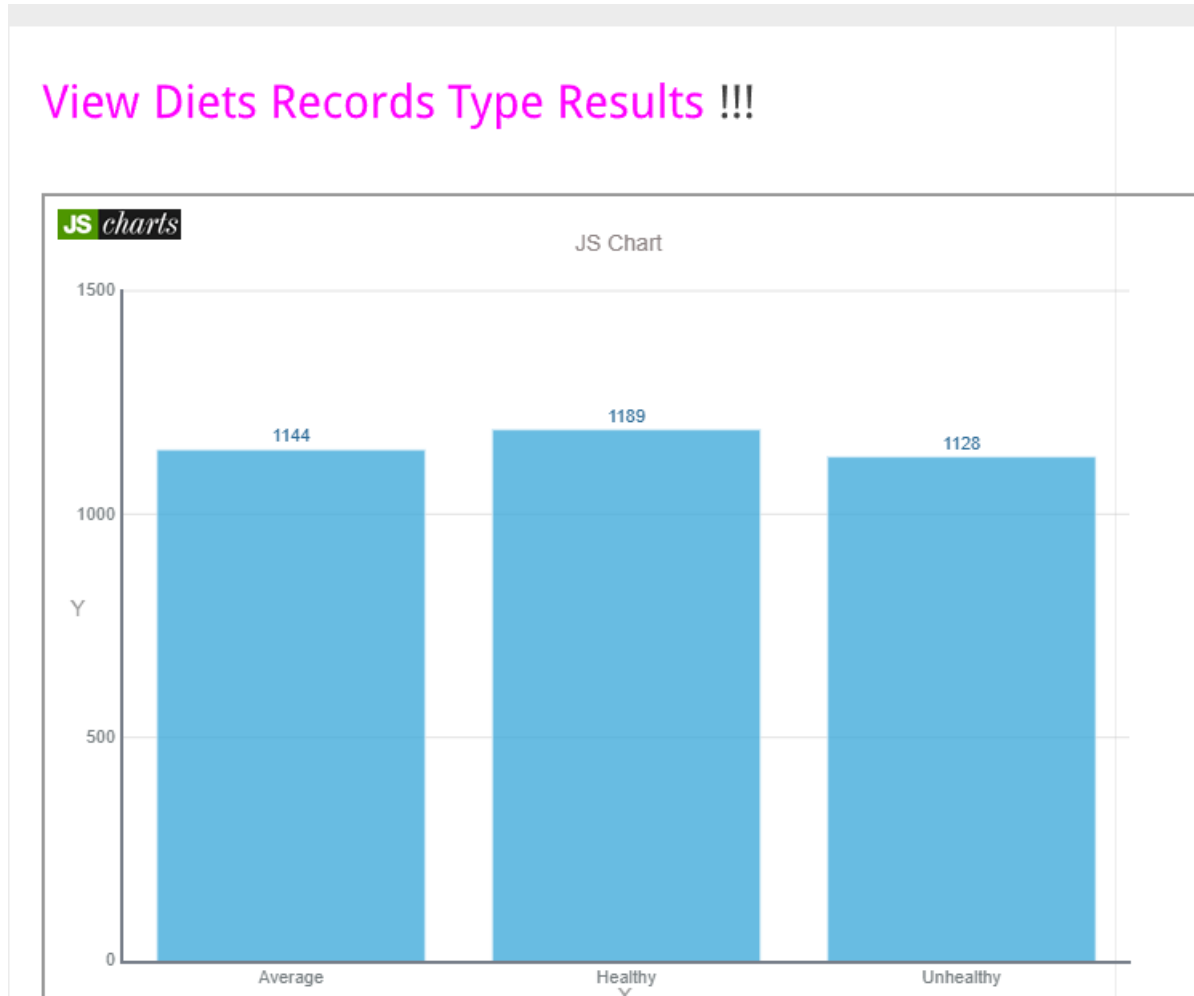


Fig 5.7

### VIEW DIET RECORDS

### 5.3.8 TYPE BY HASHCODE (SECURED):

Find Healthcare Record Type By Hashcode !!!

Patient_ID	Age	Sex	Cholesterol	Blood_Pressure	Heart_Rate	Diabetes	Family_History	Smoking	Obesity	Alcohol_Consumption	Exercise_Hours_Per_Week	Diet	Previous_Heart_F
200.4800.925.500	NjcuMA==	TWFsZQ==	MjA4LJA=	MTU4Lzg4	NzIuMA==	MC4w	0.0	1.0	0.0	0.0	4.168188835	Average	0.0
200.9200.925.200	ODQuMA==	TWFsZQ==	Mzg2LJA=	MTYzLzEwMA==	NzMuMA==	MS4w	1.0	1.0	0.0	1.0	9.828129593	Average	1.0
10.4800.925.545	NTQuMA==	RmVtYWxl	Mjk3LJA=	MTcyLzg2	NDguMA==	MS4w	1.0	1.0	0.0	1.0	0.625008024	Unhealthy	1.0
23.0000.925.382	ODQuMA==	TWFsZQ==	MjIwLJA=	MTMxLzY4	MTA3LJA=	MC4w	0.0	1.0	1.0	1.0	3.427928754	Average	0.0
10.8200.925.760	NDMuMA==	RmVtYWxl	MjQ4LJA=	MTYwLzcx	NTUuMA==	MC4w	1.0	1.0	1.0	1.0	0.194515061	Unhealthy	0.0
12.8000.925.200	NzEuMA==	TWFsZQ==	Mzc0LJA=	MTU4Lzcx	NzAuMA==	MS4w	1.0	1.0	1.0	1.0	8.251995072	Average	0.0
11.4000.925.259	NzcuMA==	TWFsZQ==	MjI4LJA=	MTAxLzcy	NjguMA==	MS4w	1.0	1.0	1.0	1.0	19.63326816	Unhealthy	0.0
10.3200.925.688	NjAuMA==	TWFsZQ==	MjU5LJA=	MTY5Lzcy	ODUuMA==	MS4w	1.0	1.0	0.0	1.0	17.03737418	Healthy	1.0
10.8200.925.683	NzMuMA==	TWFsZQ==	MTIyLJA=	MTE0Lzg4	OTcuMA==	MS4w	1.0	1.0	0.0	1.0	14.5596645	Average	0.0
10.8200.925.200	NjkuMA==	TWFsZQ==	Mzc5LJA=	MTczLzcx	NDAuMA==	MS4w	1.0	1.0	1.0	1.0	4.184648046	Average	1.0

Fig 5.8 TYPE BY HASHCODE (SECURED)

### 3.5.9 TYPE BY HASHCODE

Find Healthcare Record Type By Hashcode !!!

Patient_ID	Age	Sex	Cholesterol	Blood_Pressure	Heart_Rate	Diabetes	Family_History	Smoking	Obesity	Alcohol_Consumption	Exercise_Hours_Per_Week	Diet	Previous_H
200.99589255300	NjcuMA==	TWFsZQ==	MjA4LjA=	MTU4Lzg4	NzIuMA==	MC4w	0.0	1.0	0.0	0.0	4.168188835	Average	0
100.99589255300	ODQuMA==	TWFsZQ==	MzgzLjA=	MTYzLzEwMA==	NzMuMA==	MS4w	1.0	1.0	0.0	1.0	9.828129593	Average	:
100.99589255300	NTQuMA==	RmVtYWxl	Mjk3LjA=	MTcyLzg2	NDguMA==	MS4w	1.0	1.0	0.0	1.0	0.625008024	Unhealthy	:
200.99589255300	ODQuMA==	TWFsZQ==	MjIwLjA=	MTMxLzY4	MTA3LjA=	MC4w	0.0	1.0	1.0	1.0	3.427928754	Average	0
100.99589255300	NDMuMA==	RmVtYWxl	MjQ4LjA=	MTYwLzcx	NTUuMA==	MC4w	1.0	1.0	1.0	1.0	0.194515061	Unhealthy	0
120.99589255300	NzEuMA==	TWFsZQ==	Mzc0LjA=	MTU4Lzcx	NzAuMA==	MS4w	1.0	1.0	1.0	1.0	8.251995072	Average	0
114.68900000000	NzcuMA==	TWFsZQ==	MjI4LjA=	MTAxLzcy	NjguMA==	MS4w	1.0	1.0	1.0	1.0	19.63326816	Unhealthy	0
106.32000000000	NjAuMA==	TWFsZQ==	MjU5LjA=	MTY5Lzcy	ODUuMA==	MS4w	1.0	1.0	0.0	1.0	17.03737418	Healthy	:
100.99589255300	NzMuMA==	TWFsZQ==	MTIyLjA=	MTE0Lzg4	OTcuMA==	MS4w	1.0	1.0	0.0	1.0	14.5596645	Average	0
100.99589255300	NjkuMA==	TWFsZQ==	Mzc5LjA=	MTczLzcx	NDAuMA==	MS4w	1.0	1.0	1.0	1.0	4.184648046	Average	:
1014000000000	MzguMA==	TWFsZQ==	MTY2LjA=	MTIwLzcx	NTYuMA==	MS4w	0.0	1.0	1.0	0.0	8.91790723	Healthy	0
9500000000000	NjAuMA==	TWFsZQ==	MTQ1LjA=	MTYwLzcx	NzEuMA==	MS4w	0.0	1.0	0.0	1.0	1.89255933	Healthy	:

Fig 5.3.9 TYPE BY HASHCODE

## 6. CONCLUSION AND FUTURE WORK

### CONCLUSION

In this work, we proposed Sec-Health, a block chain-based protocol that secures health records while addressing all of their main properties, namely confidentiality, access control, integrity, access revocation, emergency access, interoperability, and anonymity. Sec-Health shows security advantages compared to related proposals that present highly centralized mechanisms. While those proposals are generally based on a trusted or semi trusted server, Sec-Health affords several decentralized features, preventing one single entity from compromising the healthcare system. Furthermore, compared to decentralized solutions, our protocol addresses the challenging problem of fulfilling all the main properties of health records, whereas other solutions focus on offering mechanisms for specific properties only.

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