Preserving Privacy of Patients Records in Healthcare Databases

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Abstract—Today in era of electronic age all the information is stored electronic format. The most important information that is the patient health data records in healthcare databases are considered as prime importance. At the same time questions are posed regarding the privacy, safety and security of patient records. Generally the peoples view with respect to privacy related to patient records is the trust and confidence on sharing of information and entire healthcare system. The public are anxious about the private information of a patient from the beginning like initial entry of information to the later stages like sharing of patient history among various kinds of users. In this paper it is proposed to offer privacy and security to patients' information available in healthcare database. The patient information can be retrieved by a variety group of people like health officials, doctors, patients etc. Security mechanism is provided through cryptographic technique before accessing the electronic health care information. The results of the query submitted by users are revealed at various levels of abstraction and thus preserving the privacy of patient information which is private..

Index Terms— healthcare database, patient, privacy

I. INTRODUCTION

A growing trend in hospitals is to keep all the documents related to patient and doctors etc. in digitized form. Such digitized database may contain patient information which is very sensitive. This raises concerns about the security of the documents being stored. Confidentiality of patient information was an issue even when it was still stored on paper. Paper documents can be easily stolen by a malicious person entry into a hospital. Moreover, hospital personnel can glance at paper documents which are not supposed to read unofficially. Confidentiality of paper documents can be enforced by keeping them in secured places .When a document is stored digitally, similar issues arise. There is still the issue of access control, namely the question of who is allowed to read or change the document, and there is the issue of easy copying. It is much easier to copy a digital document than it is to copy a document on paper. An opponent, who gains access to a workplace in the hospital, can copy documents from that computer unit. This is a problem if those documents contain patient information. The main difference with paper documents is that an adversary does not need to be in the hospital itself. Hacking a server, located in the hospital, which is connected to the internet is sufficient to gain access to patient information. With regards to integrity, it is generally easier to change a digital document, than to change a paper document, as changes on paper are more noticeable and physical access is required to be able to make the change. In this application, we aim to reduce the information leakage and protect information integrity of patient information that is stored in a central location, so that the data can be accessed only by authorized persons and that the integrity of the data can be verified. For the proposed model a medical database is considered which contains patient information, measurement data and diagnoses related to the patients. Measurement data could be anything from brain scans to lab reports. In this paper various methods are discussed to secure the information and protect the integrity of the patient information. A prototype was developed which implements these security measures in a medical database.

II. IMPORTANCE OF MEDICAL RECORDS

The patient information is confidential and needs proper security. Nowadays, large amounts of patient medical data are collected and stored electronically. Due to latest improvements there is lot of improvement in patient healthcare management due to advancement in science, innovation in medical and technical field. Today the medical records [6] of patient can be displayed in consolidated and user friendly manner to a doctor, medical staff to understand the disease diagnosis and prepare a plan for patient treatment. Today Medical records plays major role in patient care in hospital. The basic concept of medical healthcare records and treatment remain same even with the development of software and hardware technology. Patient medical records [1] contain not only the information submitted by patient but also the physician's observations, diagnosis report and treatment information. The medical history of patient's health may consist of following information:

- history and personal lifestyle
- Past Major illnesses and related records of lab reports, diagnosis and treatment plans of the illness.
- The side effects of the drugs during treatment .
- Additional Preventive healing treatment in addition to actual treatment.
- Other paper documents by the hospital authorities like date and time of admission and discharge in hospitals, patients status during the admission and discharge from the hospital.

Generally all the above said information is documented on paper. Such kinds of paper written documents are likely to consist of more error, lapse and loss of detailed information. But, today with the advancement of technology these medical records [3] can be stored in digital form. Today the medical database can be accessed and particular patient details can be searched instantly with reduction in human error. With tremendous [5]

growth in medical records, healthcare system became more cost-effective. Medical experts are using data-driven medical records and offering better patient care. There is continuous monitoring on therapies, effectiveness of medication, and make predictions about expected results for the entire course of a patient's stay period. In healthcare system it is not simply a storage of patients information, but also to keep systematic records of patients symptoms, diagnosis, and medication. Lack of such facility and follow up, any doctor who treats patients afterwards will not be able to provide the best possible care. Hence the medical history records of a patient should be utilized to the maximum for providing best treatment.

III. ISSUES TO PROTECT THE PRIVACY OF PATIENT HEALTHCARE RECORDS

Like with any other information available in digital format, there is possibility of violation of patient records by Internet hackers. The patients' sensitive information can be accessed by the intruder and can cause harm to patients directly or indirectly. Though not frequent, but such occurrences of unauthorized access of patient information causes suspicion and distrust in the brains of doctors and patients. Illegal access of patient private information in records can damage the person's reputation, finances and relations in society..Hence to protect the patient privacy in electronic healthcare databases, top-quality software with high security provision is required to eradicate the consequences of the problem.

IV.PROCESS TO GUARANTEE SECURITY AND PRIVACY

While converting health records from manual form to Electronic form, The healthcare database provider [7] must also work for secure transition.

Following are the few solutions to provide privacy and security for electronic health records.

- Time to time modernization of the security policies and procedures
- Conduct training programs on privacy preservation to the employees of healthcare database.
- Monitor the behavior of all employees.
- Provide unapproachable systems to intruders.
- Provide immediate restoration of data in case of emergency.
- Provide user authentication to all system users.

V. PROPOSED METHOD

In the proposed system patients information is maintained in patient database. Patient health record which is controlled by the patient and information is submitted by the patient that is clearly defined in an electronic application format and patient is informed to authorize the persons who can access and share the patient health information in a private, secure and confidential environment. In electronic health record maintained by hospitals or healthcare database system only doctors and administrative staff will have access to patient health records with different way of representation.

Patient database includes patient's medical history and related Doctor details. To preserve the privacy of patient details from unauthorized users a security mechanism is provided. A security key [8] is provided for patient as well as doctor to look in to the details. The keys are exchanged between patient and Doctor by secure mechanism. If other user wants to access the details of a patient they will get the information which is in the cipher or encrypted form and cannot be understood by any one. To provide the information to health officials or government officials, those who want to know the details of severity of disease spread in a particular location and take necessary measures, the information is provided to them but at very high level of abstraction. Such authorities are not provided with either patient or doctor details.

Fir.1 shows four types of users i.e. Doctor, patient, unauthorized user and health officials. The entire users have to follow login process and get validated. Based on patient query, he receives his medical prescription, and the doctor details in encrypted form. The patient can decrypt the information as he already has the secret key assigned to him to during login process. Similarly a Doctor can get patient details in encrypted form and get it decrypted with secret key. An unauthorized user cannot get details because of unavailability of login details in the server.

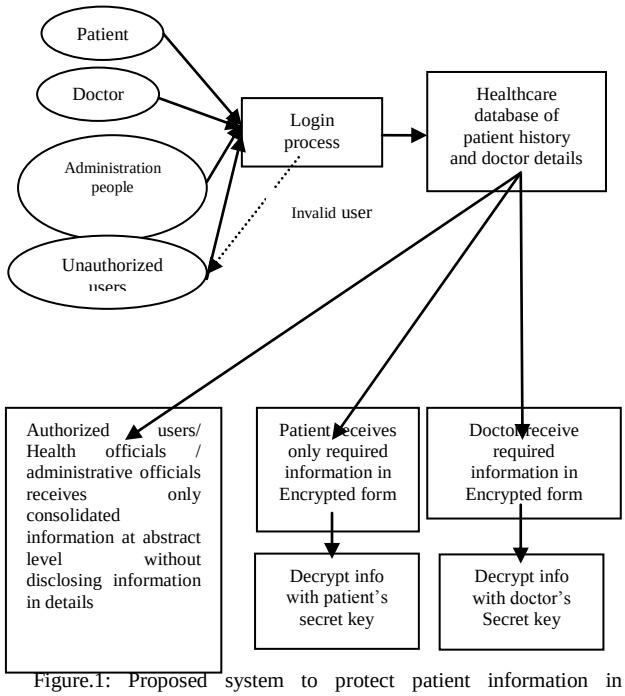
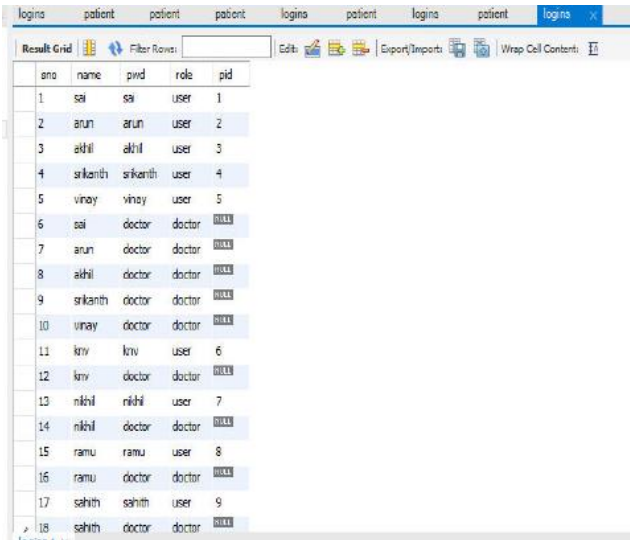


Figure.1: Proposed system to protect patient information in healthcare database

Test procdure:

Figure 2 shows various users based on their categories like officials, doctors, patients and unauthorized users. The details of patient records in healthcare database are shown in Fig3.



ano	name	pwd	role	pid
1	sai	sai	user	1
2	arun	arun	user	2
3	akhil	akhil	user	3
4	srikanth	srikanth	user	4
5	vinay	vinay	user	5
6	sai	doctor	doctor	NULL
7	arun	doctor	doctor	NULL
8	akhil	doctor	doctor	NULL
9	srikanth	doctor	doctor	NULL
10	vinay	doctor	doctor	NULL
11	knv	knv	user	6
12	knv	doctor	doctor	NULL
13	nikhil	nikhil	user	7
14	nikhil	doctor	doctor	NULL
15	ramu	ramu	user	8
16	ramu	doctor	doctor	NULL
17	sahith	sahith	user	9
18	sahith	doctor	doctor	NULL

Figure.2:Login details of different kinds of users

snum	fname	lname	sex	age	dob	hno	street	city	district	pincode
1	Sai krishna	Metpalli	Male	21	15-04-1995	2-12-292/1	Vidyaranyapuri	Hanamkonda	Warangal	506009
2	Arun kumar	Gugja	Male	21	13-04-1995	1-108	Mallaram	Sheemadevarapally	Kanmnagar	505471
3	Akhil Reddy	Muppidi	Male	22	28-04-1994	2-1-3	Ramnagar	Hanamkonda	Warangal	506001
4	Srikanth	Sadiram	Male	22	15-08-1994	5-4-9	Kishanpura	Hanamkonda	Warangal	506004
5	Vinay Reddy	Bitla	Male	21	31-05-1995	1-108/2	Balasamudram	Hanamkonda	Warangal	506001
6	Naga Vara Prasad	Kandukuri	Male	21	31-08-1995	123	Alwal	Secunderabad	Rangareddy	509001
7	Nikhil	Sutari	Male	22	21-07-1994	456	Nakkalagutta	Siddipet	Medak	502001
8	Ramu	Ayrneni	Male	30	06-08-1986	7-78/3	Advocates colony	Suryapet	Mahabubnagar	509001
9	Sahith	Peddapally	Male	53	12-12-1963	789	Jawahar colony	Bhongir	Nalgonda	508001
10	Swetha	Erukula	Female	40	05-01-1976	1-34	Ramnagar	Mancherial	Adilabad	504001
11	Madhuri	kalakunda	Female	18	14-02-1998	123	Vidyanagar	Hyderabad	Hyderabad	500001
12	Anjali	Gummadala	Female	10	24-04-2006	777/7	Chaitanyapuri	Nizambad	Nizambad	503001
13	Abhinay	Kancha	Male	25	05-05-1991	456	Kishanpura	Kodad	Khammam	509001
14	Chaitanya	Vemula	Male	15	09-06-2001	1-2/7	Palivelpula	Hanamkonda	Warangal	506001
15	Rahul	Enugula	Male	30	15-10-1986	678	Reddy Colony	Hanamkonda	Warangal	506001

Figure.3: patient record details in healthcare database

Fig.4 below shows the information received in encryption form by the patient or doctor.

Figure4:The Encrypted form of data is visible to the users like patient and doctor.

Figure 5 shows the details which is decrypted by the private key of patient or doctor.In case of any query form higher official or administrative person as shown in Fig.6, the results are submitted in very abstract form hiding all other details as shown in Figure 7.In this case only the total number of patients with particular disease is shown, hiding all the personal details of the patient.

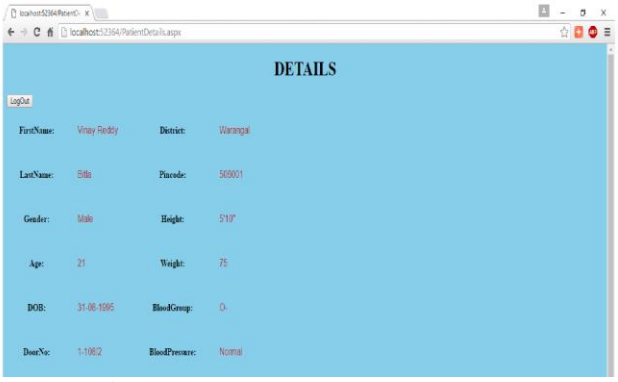


Figure.5: Information in Decrypted Form to the patient and doctor

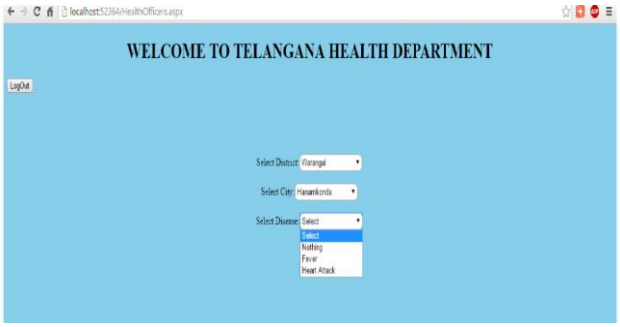


Figure.6: Query submitted by health officials

Figure7: Result to Health official giving only the total no. of patients suffering with disease

VI CONCLUSION

One of the challenging tasks today is to provide balance between privacy of patient data in healthcare databases and share the patient information among various users like doctors, relatives, administrative staff, research organizations etc. The healthcare database providers must provide high level of security to individual patient health information and also increase coordination among various users of such database.

In this paper it is proposed to protect the privacy of patient record information by two methods. First, security technique is use to share the information available in healthcare database and second the data is available or disseminated to various users based on their query at various level of abstraction without disclosing the complete information.

REFERENCES

[1] Edwin Morley-Fletcher, " Big data healthcare", Dove press journal: opern acces bio-informatics.2014

[2] Omer Tene, Jules Polonetsky, " Big data for all: privacy and user control in the age of analytics" , North western journal of technology and intellectual property, 2013

[3] Hiromi Arai," Privacy preservation in crowd sourced health research "Ambient intelligence for health and cognitive enhancement, AAAI Spring syprosium, 2015.

[4] V.M.Prabhakaran, S.Balamurugan, " Privacy preserving health care data in cloud" ,international Advanced journal in science engineering and technology,2014

[5] D.Aruna kumari "privacypresrving data mining in healthcare applications", International journal of Advanced computer technology, vol3, no.3

[6] Tamas Aoltan Gal, Gabor Kovcs" Survey on privacy preserving data mining techniques in healthcare databases"Acta univ,Sapientiae, informatica,, 2014.

[7] Aritara das gupta etl." Opportunities and and challenges for privacy preserving visualization of electronic health record data" ,IEEE VIS2014 proceedings.

[8] Johannes Heurix,etl."Privacy preserving storage and access of medical data through Pseudonymization and encryption", Springer 2011.