PROVIDING SECURITY WITH BIOMETRIC SYSTEM TO THE HEALTH DATA USING CLOUD STORAGE

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Abstract—To productively look after their patients, different on-screen characters and substances (like medicinal experts, medical attendants, unified wellbeing experts, healing facilities centers, hospices, etc) regularly need to exchange significant amounts of information in real time. Quiet created information or individual clinical information in general is viewed as an essential angle in enhancing tolerant results. Be that as it may, individual clinical information is hard to gather because of their disseminated nature, i.e., situated over numerous spots, for example, specialist's office, radiology focus, doctor's facilities, or, on the other hand a few facilities, and heterogeneous information sorts, for example, content, picture, diagram, or paper based archives. In the event of crisis, this circumstance makes individual clinical information recovery nearly unimaginable since the sum and sorts of individual clinical information keep on growing. Finding applicable clinical information when required is getting more troublesome if no moves are made. In general, after a patient visits a healthcare provider (such as a general practitioner for an annual physical examination, a nurse practitioner to obtain a flu vaccine, or a radiographer for an x-ray), he or she will likely require additional medical services or consideration over a period of time (for example, specialized medical examinations such as attractive reverberation imaging filters, or, on the other hand routine restorative examinations, for example, blood tests, cholesterol checks, and glucose checks). Accordingly to such situations, we propose an approach that oversees individual wellbeing information by using meta-information for organization and easy recovery of clinical information and cloud storage for easy access and sharing with caregivers to implement the continuity of care by using unique identity number of a particular patient.

Keywords—Personal Health Records (PHRs), Personal Health Records Systems (PHRS), Dublin Core Metadata, Cloud storage, Standard Medical Codes, Biometric Technology.

I. INTRODUCTION

For most of people, healthcare is considered important. For a large portion of individuals, human services is viewed as critical as we encounter the expansion in unending infections, for example, coronary illness, tumor, diabetes and asthma, which requires consistent treatment and expands general medicinal costs [1].

As per the Centers for Disease Control and Anticipation (CDC), in the USA around 620,000 individuals bite the dust of coronary illness consistently [2], around 27 million individuals experience the ill effects of Type I or Type II Diabetes, around 15 million have extreme constant respiratory issues, for example, Chronic Obstructive Pulmonary Disease (COPD) and 70 million have been determined to have hypertension [3]. Be that it may, a considerable lot of these sicknesses can be averted and overseen through right on time recognition, physical exercises, an adjusted eating regimen and treatment.

As of late there have been more concentrate on preventive care or checking and control of the manifestations. In these days, there are numerous versatile wellbeing applications and sensors such as circulatory strain sensors, electrocardiogram sensors, blood glucose measuring gadgets, and so on are utilized by the patients who screen and control their health standards. These applications and sensors create individual wellbeing information that can be utilized for treatment purposes and it can be considered as patient-generated data. There are other types of personal health data that are available from various sources such as hospitals, doctor’s offices, clinics, radiology centers or any other caregivers. All these health documents are deemed as a personal health record (PHR). As indicated by AHIMA [32], PHR can be characterized as an electronic, fundamental asset of wellbeing data required by people to make their health choices. But it is difficult to gather and access all the significant individual information from various above sources, and further, put away in various media and gadgets. To overcome such challenges, it is attractive to have PHR in one place where clients have full control over their own clinical information and this can be sharable when
required for the conclusion and treatment. Without appropriate, insufficient clinical data and it isn’t sharable, then it may affect on treatment at critical moments, irregularity in care may also happen. Keeping in mind the end goal to address the issues of such situation, PHR to have the accompanying properties like data as private, simple recovery and support, secure, sharable, and have the capacity to deal with crisis circumstances. There are two sorts of individual record frameworks – untethered and fastened PHRs. Untethered PHR is free PHRs where patients have full control over their very own wellbeing records gather, and share. Then again, the fastened PHRs is connected to a particular social insurance suppliers’ (Electronic Health Record) EHR framework where the clients ordinarily increase simple access to their claim records through secure entries and see their own particular clinical data, for example, test comes about, inoculation record, family history, and so on [36].

In spite of all be benefits PHRs give, the selection rate of PHR by the overall population still stays low in the US. In our past work [16], we recognized seven obstacles – (convenience, proprietorship, interoperability, protection and security, convenient and also inspiration) that reason the moderate selection of PHRs. One ownership incident happened on January 1, 2012, Google Health TM System, one of the biggest PHRs providers, stopped its service and asked their registered customers to move their records to their computers or other PHRs vendors which exacerbated ownership concerns by the public.

As an attempt to overcome some of the barriers, we propose an un-tethered PHRS that utilizes personal cloud storage, offers simplicity in organizing various kinds of clinical data by utilizing Dublin Core (DC) metadata [35]. In this paper, we began our discussion by analyzing the problem as it relates to the user’s needs and expectations for collecting, maintaining and accessing their personal health records and proposes the use of unique identification number in biometric system. There by we achieve paperless records of patients. The other part of this paper is structured as follows: Section 2 discusses related work and section 3 explains about the structure of clinical data in regards to its type and format. In Section 4 we discuss about metadata to facilitate better and more accurate data retrieval. In section 5 talks about cloud storage. In section 6, we introduce biometric technology for easy access and retrieval of metadata of a particular user and finally we conclude our study and discuss our future work in section 7.

II. RELATED WORK

In the healthcare field, metadata has been used as a method to use confidentiality tags that indicate data sensitivity levels. This enables patients to give consent to the exchange of some parts of their health records (e.g. the medical diagnosis) while withholding consent for the exchange of other areas (e.g. a mental health counseling session) [15]. Other researchers have adopted the ontology approach to quickly search and access relevant and meaningful information among large numbers of CDA documents within healthcare providers’ systems (Electronic Health System), which in turn enable semantic interoperability [4]–[7].

Patel et al. [7] built a system called TrialX on top of PHR where patients not only can search by keywords, as in ClinicalTrials.gov, but also by demographics (e.g. age, gender, city and study site). This system enables patients to match their health condition to clinical trials.

Appelboom et al. [8] reviewed the literature on smart wearable body sensors and found that these sensors are accurate and have clinical utility, but still are under-utilized in the healthcare industry. These devices can be used to monitor physiological, cardiovascular and many other factors of health variables and transmit data either to a personal device or to an online storage site. The smart wearable body sensors are placed on different parts of the user’s body based on the purpose of the sensor device, e.g., the physical therapy sensor is placed on the ankle; the cardio pulmonary sensor can either be placed on wrist, finger, arm or thigh.

Zhang et al. [9] developed an application to apply metadata efficiently on clinical trial data. The authors chose Microsoft Excel due to the wealth of built-in features (e.g. spell checking, to sorting, filtering, finding, replacing, importing and exporting data capabilities) which contribute to the ease of use, power, and flexibility of the overall metadata application. They focused on the analysis process in a drug development environment such as ACE (adverse clinical events), ECG (Electrocardiogram), LAB (laboratory), and VITAL (Vital Signs) where the raw data is stored in the clinical trial database and then manipulate the data.

Teitz et al. [10] developed a website called Health Cyber Map with the goal of mapping Internet health information resources in novel ways for enhanced retrieval and navigation. They are using Protégé e-2000 to model and populate a qualified DC · RDF metadata base. They also extended the DC elements by adding quality and location elements of the resource. Also, the W3C RDF PICS project extends
the DC schema by adding its own elements such as camera, film, lens and film development date for describing and retrieving digitized photos [10].

Ariel Ekhlaw et al. [11] built a system (RedRec) to enable patients to access their medical health records across health providers (e.g. pediatrician, university physician, dentist, employer health plan provider, specialists, etc.). Their system applies novel, blockchain smart contracts to create a decentralized content-management system for healthcare data across providers. The RedRec governs medical records access while providing the patient the ability to share, review, and post new records via flexible interface.

Mohammed Abdul Karem Alyami [35] explains about comprehensive study that covers many different clinical and nonclinical documents such as images (e.g. x-ray, scanned document, ultrasound, etc.), text (e.g. CDA, CCR, CCD, etc.), observed symptoms noted by patients, clinical sensors data, etc., which can help to organize these various data in a way that can help in storing and retrieving such data in an efficient way by using meta-data and cloud storage.

Hence the existing systems focused on either single domain or gathering information and storage but in our study we introduce efficient and standard mechanism for accessing all the information related to patient in any place with the use of biometric system by linking their unique identification number, their by we can also reach the goal of digital documents. There by we can access all health records of clients easily in every where without any disturbances (like forgot, missing of records etc).

III. MEDICAL DATA

In this segment, we portray the arrangement and sources of the clinical information and the systems on the best way to store and recover them.

A. Estimating information from medical gadgets, sensors, or portable applications:

A clinical sensor is a gadget that reacts to a physical jolt and transmits a subsequent impulse clarification for recording. A few sensors are intended to work outside the human body while others can be embedded inside the human body. In this paper, we are alluding to the sensors for the homecare setting, for example, blood oxygen screens, thermometers for body temperature, heart rate, sensor glucose (SG), pulse, and so forth. There can be non-printed information created from sensors, for example, electrocardiogram estimation gadget. The clinical sensors assume significant parts in social insurance, including early recognition of illness, conclusion, sickness observing and treatment checking [24].

Another strategy to gather estimation information is Mobile health Applications. For example, most cell phones (e.g. Android, iPhone, Samsung universe, and so on) offer wellbeing and wellness applications that assistance clients to screen their every day exercises and wellbeing (e.g. track eating regimen and sustenance calories, track fundamental signs, track wellness advance, share wellbeing information with their specialist electronically, etc.). The information gathered from these applications can be sent as a message or an email connection to which the clients need to share it with [26].

B. Watched Symptoms

Patients now and then experience specific side effects (e.g. chest torment, sickness, spewing, shortness of breath, and so on.). On the off chance that the tolerant notification, they ought to be recorded and imparted to their doctor for legitimate treatment. On the off chance that those are not imparted to their doctor, because of fragmented data, misdiagnosis could happen. When recording, the watched indications ought to be portrayed in institutionalized code, for example, SNOMED-CT for semantic interoperability as similar manifestations can be portrayed in different ways [29].

C. Pictures

A large portion of the medicinal imaging machines create standard picture organize called Digital Imaging and Communications in Pharmaceutical (DICOM).

There are two sorts of clinical information pictures: pictures that depend on DICOM standard (e.g. x-beams, Processed Tomography (CT), Magnetic Resonance (MR), what's more, ultrasound gadgets) and filtered archives. DICOM is characterized as the universal standard for restorative pictures and related data (ISO 12052) [27]. The DICOM organize consolidates pictures and metadata that portrays the therapeutic imaging strategy. [28].

On the other hand, the filtered reports (e.g. PDF/JPEG) are hard to recover on the grounds that the substance isn't accessible. For instance, a few doctors compose notes on clinical structures while diagnosing their patients and afterward sort them on the PC or simply examine them and transfer them to the patient records. Whichever way is tedious, hard to recover in an opportune way, and expends generally extensive storage room. What’s more, the patient may have more than one specialist or had been dealt with
by numerous wellbeing suppliers, which thus parts his/her records. So when the patients get their records, they generally got them either printed out or sent as an email connection. This thusly makes it hard to recover checked archives since its substance can't be recovered by PCs. To lighten such issues, we have used metadata to portray such restorative reports so modernized recovery also, deliberate association are conceivable.

D. Health Document

EHR information might be gathered from medicinal services suppliers. There are three sorts of clinical report positions: Continuity of Care Record (CCR), Clinical Document Architecture (CDA), furthermore, Continuity of Care Document (CCD) - that permit human services suppliers to trade clinical data rundown about a patient. Yet, CCR was prohibited of the 2014 Edition of EHR accreditation as a legitimate approach to send synopsis of care reports. Consequently, the substance from a CCR was converted into a CDA design. Presently, with Meaningful Use Stage 2 and the 2014 Edition of EHR affirmation, Consolidated CDA incorporates CCD as one of its record sorts [34]. When utilizing un-tethered individual wellbeing record framework, patients are in charge of gathering clinical information from their medicinal services suppliers or their own patient created estimation information and keep it in their own stockpiling, for example, individual cloud space. For instance, CDA, CCR and CCD can be acquired from human services suppliers; X-beams can be gotten from the radiology division, and lab test comes about because of test lab or doctor’s office.

Patients can share their health records with their clinicians by either electronically transmitting or granting access to their storage through the PHRS or by put thumb or by typing UIN on biometric system. Whenever if electronic sharing is not allowed, the patient may download the file and make hardcopies or store them in USB, CD, or other mediums for sharing Clinical information should be put away in one place for simple sharing furthermore, recovery. In our approach, we isolate the clinical information from applications to make the information free from the application. Additionally, the clients can have elective applications for their clinical information. Our proposed idea is represented in Fig. 1. In the figure, the clinical information is isolated from the application for data independence with the help of biometric system.

E. Biometric System:

This technology enables the client to access, view, and record clinical data in computerized form. Not only patients as well as different substances (like doctors, medicinal experts, medical attendants, unified wellbeing experts, healing facilities centers, hospices, etc) are also share clinical documents among them. For accessing information this system needs either thumb impression or Unique
IV. METADATA

Metadata benefits personal health record management in many ways. Among those are:

• Consistency in definitions: Properly defined tag provides structured information about the clinical data users stored.

• Clarification of the relationships: metadata can be used to clarify the relationships among the clinical data by defining categories and associated relationships in the category. There are two different methods of storing metadata. In the first method, metadata can be embedded in the data (e.g. in the header of digital file) [35].

Table 1 shows which information contained in the document that is metadata.

V. PERSONAL CLOUD STORAGE

Cloud storage is a cloud computing model where users can store their data and access it anytime, from anywhere, and from any device via the Internet. It is maintained, managed and operated by cloud storage service provider [23].

Table 1: Meta-Data Schema for PHR

<table>
<thead>
<tr>
<th>Entity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>The title of the uploading document</td>
</tr>
<tr>
<td>Creator</td>
<td>The author of the document</td>
</tr>
<tr>
<td>Subject</td>
<td>Chief complaint/ reason of visit (pick lists)</td>
</tr>
<tr>
<td>Description</td>
<td>Abstract</td>
</tr>
<tr>
<td>Relation</td>
<td>One of the body parts (Thorax, Abdomen, Heart) this element is linked to the subject element</td>
</tr>
<tr>
<td>Date</td>
<td>Date of visit, lab test, x-ray, etc</td>
</tr>
<tr>
<td>Type</td>
<td>Type will be used for test for labs (blood work, urinal etc) or images (x-ray, cat scan, CT or ECG etc)</td>
</tr>
<tr>
<td>Format</td>
<td>PDFs, Text, JPEGs, TIFFs, etc.</td>
</tr>
<tr>
<td>Identifier</td>
<td>Document ID</td>
</tr>
<tr>
<td>Language</td>
<td>English and other languages</td>
</tr>
<tr>
<td>Coverage</td>
<td>Geographical and time-related information</td>
</tr>
<tr>
<td>Rights</td>
<td>Copyright and access rights (secured or unsecured)</td>
</tr>
<tr>
<td>Source</td>
<td>Data source</td>
</tr>
</tbody>
</table>

Cloud storage services have many focal points, for example, cost funds, usability, capacity to share information, accessibility, and sustain-ability.

Personal Cloud Storage (PCS) is getting more popular because of the aforementioned convenience. Any cloud storage service provider may be used - SugarSync, Carbonite, IDrive, Dropbox, Google Drive, etc. [22] for storing personal clinical data as long as they provide required functionality and security. In our proof of concept, we are currently using DropboxTM as storage with MCRS technique [35].

VI. BIOMETRIC TECHNOLOGY

Healthcare biometrics refers to biometric applications in doctors’ offices, hospitals, or for use in monitoring patients. This can include access control, identification, workforce management or patient record storage. Secure identification is critical in the health care system, both to control logical access to centralized archives of digitized patients’ data.

There is also an increasing need to identify patients with a high degree of certainty. Identity verification solutions based on biometric technology can provide identity assurance and authentication while increasing privacy and security. Biometric technology can add operational efficiencies to the healthcare system that reduce costs, reduce fraud, and increases patient satisfaction by reducing medical errors. As electronic health records (EHRs) and personal health records (PHRs) become more commonly used, biometrics will be utilized as an authentication mechanism by both medical facilities and insurers.

Records must be kept every time a patient’s electronic record is accessed. Biometrics permit medical professionals to do this easily since their use of a biometric identifier can be automatically and digitally recorded each time a medical record is opened. A number of biometric equipment manufacturers and service providers offer turnkey applications that maintain and track access to EHRs [37] this whole process is shown in figure 3, in simple when patient consult doctor without his/her medical records even though the doctor is able to view/access that particular health records with the use of biometric.

If Electronic System is not available to the patient then he/she access their information by logging with their credentials like UIN number, name and password as shown in figure 2 and figure 4 shown sample example metadata of all documents for a particular user after logging. They can also view and download any document from that metadata what the user want.
As the medical industry is going through a paradigm shift from clinician-centered to patient-centered, readily available complete personal medical history became crucial part to ensure the three major goals in medical industry: evidence-based treatment, continuity of care, and prevention of medical mistakes. In this paper, we proposed an un-tethered personal health record system to implement such goals. Our proposed system Biometric technology allows easy access, security and paperless concept with the help of either Unique Identification Number or thumb impression of patient. Finally, we allowed the personal access of clinical data from cloud by using the internet with their UIN number at the time of need. For future work, we plan to propose m-Health (Mobile health) - with this Smartphone’s and tablets allow healthcare providers to more freely access and send information. Physicians and service providers can use m-Health tools for orders, documentation and simply to reach more information when with patients.

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