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A SURVEY ON DATA PRIVACY IN ELECTRONIC PRESCRIPTION

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Abstract

In this digital world with high advancement of technologies, there is utmost need to perform technological advancement in healthcare domain. In this covid-19 situation each citizen must feel that if the doctor can pass the prescription electronically, then not required to visit the hospitals. At the other end, privacy of patient history or data is again critical task at the time of handling E-prescription. This paper represents different approaches that are taken towards the data privacy in electronic prescription, it talks about different methods through which privacy of any electronic prescription is maintained. Electronic prescription is the digital version of having a prescription, it involves sending of prescription through the internet to the patient's account which it is meant to. Talking about storage despite its utilization, there are also several hindrances with regards to the protection of data which is being stored to the cloud. Highly professional and encouraging hackers are now attempting their possible best to intercept or thieve large amounts of data consisting of vital and critical information that has been transmitted or stored in the cloud. In this paper, thorough study and analysis talk about how a user can be authenticated using different mediums or methods to ensure that prescription is delivered at the right place and a brief comparison between how the electronic prescription has been implemented in several developed countries. We will also look on the usability and the deployability of electronic prescription in these developed countries.

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I. Introduction

Medical Prescription is a very important part in the healthcare sector. Every healthcare centre, hospital, point of care has its own format of a prescription. It allows a patient to buy the medicine as prescribed by a physician/doctor. A prescription written by a registered doctor ensures the liability of the person taking those drugs/medicine, that the drugs/medicine will not be used for any illegal or unlawful purposes. However, the paper-based prescriptions are often handwritten by the doctor, patients often have problems reading the data written in it. There is also a possibility of pharmacists giving the wrong medicine because of unreadable prescriptions. These kinds of problems may put the patient's health in danger. Another issue is keeping the prescriptions safe, as it is just a piece of paper, the danger of losing it, or damaging it is high. There are people that are regular patients of diabetes, cholesterol, etc So they can't afford to lose their prescriptions.

"Electronic/Digital Prescription" is the generation and transmission of medical prescriptions is done electronically with the use of computers. It makes the conventional paper and fax prescriptions obsolete. It is considered to be a legible, error-free and reliable alternative to the handwritten prescriptions which tend to be more erroneous and at times, fraudulent. Electronic prescription was legalised in 2007, from the following year the adoption of this technology was easier for the targeted healthcare industries. Surescripts, a company which was one of the earliest to work on the said Electronic Prescription. In 2010, over 300 million electronic prescriptions were processed by the above-mentioned company which was a huge milestone since it only began its service two years prior. [1]

Conventional prescriptions are mostly handwritten and paper based. The major problem with that is accessibility, since it is the only record, it can only be available to one person at a time. A second limitation, as it is paper based, preserving it is also a concern. Loss, theft, damage are some minor issues to be listed. These digital prescriptions have to be stored digitally, so the main concern occurs about Digital Privacy. The data in focus is here, a medical prescription, is very sensitive and it would be dangerous if it gets in the wrong hands, and the world as we know is not so fair, so there is no other option rather than to protect the data as securely as one can.

This paper is divided into two sections, Section I(this) starts off with the introduction of the problem, Section II is subdivided into parts Part A discusses the several proposed techniques in order to overcome the above-mentioned problem, viz., Bar Coding System, Digital Card System. Part B presents the data privacy required for the patient's data. Part C, shows the comparison between how the electronic prescription has been implemented and proposed for digital health system architecture in several developed countries.

II. Literature Survey

Digital prescription seems a new topic but there has been research going on the development for a long time. There are several different approaches adopted by people around the globe. But one thing or you can say issue is common in all of them which is privacy of patient's critical information. We have referred several papers on digital prescription as well as the storage and security. In this paper you will understand the implementation or research going on this topic.

We have studied two types of methods to implement *E*-prescription. One in which it uses bar code to store and second in which they have use physical card just like any other card out there (i.e. Credit card, Debit card).

A. Bar coding. First, in this field the United Kingdom's National Health Service (NHS) have generated a system for condensing a 128-bit symmetric encryption key into a Code 128 barcode for use in the Salford model.

(1) Salford model: In the wake of inspecting the plans that as of now ensure information privacy, we became on corned that no single strategy offered a totally ideal arrangement: one in which the patient holds adaptability over which drug specialist to go to (and when), controls the protection of their remedy data while it is on the way, is economical, hearty, and not mistake inclined or defenseless to any innovation or hardware disappointments. In our ETP arrangement, the Salford model, we joined and enhanced existing ETP models' best features. [3]

The Salford model is itemized in an earlier work [3] we give a review of the arrangement for patient privacy in this article. In the Salford model, obligation regarding keeping the electronic remedy hidden stays with the

patient by means of a symmetric key barcode. The product arbitrarily creates a symmetric key, utilizing it to encrypt the electronic prescription. A regular 1D barcode is then imprinted on a paper prescription to hold a portrayal of this key. The prescription is still imprinted on the paper prescription structure, consequently presenting reliability and robustness in the event that innovation crashes. The product additionally prints a second 1D barcode tag (the recognizable proof barcode) onto the paper prescription, which finds the prescription in the central store. At last, the electronic prescription is moved by the product to a focal store, where it stays in its encoded structure. At the point when the patient wishes to fill the prescription, the person simply just takes the paper prescription containing the symmetric key barcode to their picked drug store. The distinguishing proof and symmetric key standardized identifications are filtered by the pharmacist, and the electronic prescription is consequently recovered from storage and decoded by the product.

(2) Symmetric key user testing: "2 3 4 5 6 7 8 9 A B C D E F G H J K L M N P Q R S T U V W X Y Z a b c d e f g h j k m n p q r s t u v w x y z = @ # /"

These 59 symbols the reason for radix 59 math. We can utilize this number space to represent symmetric keys. We utilize a 24-digit number imprinted in six four-digit groups. Figure 1 shows a case of the symmetric key representation. [4]

An example Code 128 barcode containing a 128-bit symmetric key with its symbolic representation printed below

Figure 1. Encrypted Bar-code [3].

To guarantee the symmetric key barcode thought had trustworthiness in reality, they tried whether the barcode's figure printed portrayal was usable. The test comprised of inputting two arrangements of encoded symmetric keys on the keyboard.

One set utilized the full 94 single key capable characters from the Code 128-character symbology (eliminating characters, for example Æ, yet keeping uncertain characters, for example, zero and ϕ) and the other utilizing the decreased 59-character set. We tried 10 clients, assessed how long it required for them to enter each set, and noticed their error rate while moving the textual representation to the system. The test's other function was assessing whether the diminished set made information passage simpler. For this, we assessed the outcomes and furthermore asked clients which test they preferred.

Drawback of bar-coding system:

From the study we can observe following drawbacks with barcode system:

- Limited storage space.
- Only store in word type.
- Not have additional encryption decryption, so not so secure.

For this Study of U.K., this is the one way to implement digital prescription. They use java to generate this code and attach a prescription with it. This prescription is only stored in a world file. And as it is 128- bite only the storage limitation is a major problem of this method.

Improvement

To overcome the drawbacks of barcode system, once can use QR-code. By doing that we can even store pdf file type prescription too and or in any other format. There is inbuilt library in python language called QRcode version 6.1*(latest at Jan 14, 2019), we can directly integrate it and replace with bar coding system. [5]

B. Digital Card. Another approach used for this digital prescription is the Card system. As the name suggests you already get to know that is uses card to store and transfer patient's data. It is not fully digital but it uses chip to do all the task.

(1) Architecture: In its easiest structure the medical prescription client must have the option to generate an electronically designed prescription, sign it with the physicians' electronic signature and pass it to the drug database. By and by, the customer will likewise speak with the medication database

and patient data system and, perhaps, incorporates schedules for checking the legitimacy of a prescription. [6]

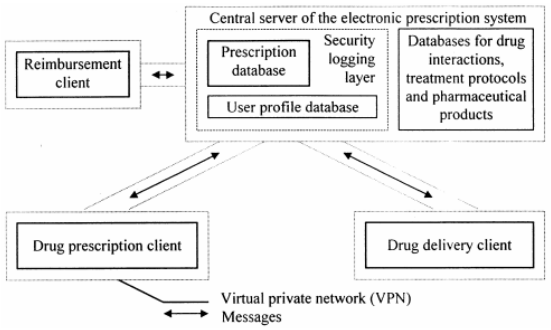

Figure 2. Abridged system architecture of the electronic prescription in TROPPI. [6]

The medicine database contains data about medical prescription. The database assistance is liable for most security issues. The admittance to various data items is based on regulation and can be additionally characterized by the patient. System must check all the exchanges and keep a sign on them. It should likewise have the option to create exchange reports for people who are eager to perceive how their information have been utilized.

(2) Certification of Software: In its most straightforward structure, the medical prescription customer must have the option to produce an electronically organized prescription, sign it with the doctors' electronic signature and pass it to the prescription database. In action, the customer will likewise speak with the medical dataset and patient data system and, potentially, incorporates schedules for checking the legitimacy of a prescription. [6]

The assessment of solution programming is an intricate procedure. The more the system is reliant on information puts together supporting dynamic with respect to medical treatments, the more clinical assessment is required. Assessment could incorporate specialized features, for example,

- Data reliability and security of data transfer solutions Integrity and back-up routine of prescription files
- Recovery and support service at all hours

- User interface
- Technical functionality of checking mechanisms for dangerous drug dosages, etc.

(3) Medical facets of evaluation could include:

- Medical relevance of drug interaction knowledge base
- Implementation and updating of treatment protocols according to objective research results
- Dosage adjustments for different diseases, age and weight
- Coverage of adverse drug reaction registry
- Consistency of contraindications among different trade names

(4) Implementation. This method is quite more secure than the first method we discuss earlier. Even this kind of method is used by companies like Apple. Apple gave services of Apple Health to the user of the Apple product, though there is no physical card but users get Apple health ID.

(a) Health Card [7]: A Health EMI Network Card is a single solution that allows you to pay for healthcare bills that you incur for you and your family, in EMIs. You can use the card to divide your hospital, pharmacy or diagnostic bills into No Cost EMIs avail 800+ treatments such as dental care, eye care, hair transplantation, stem cell banking, diagnostic care, and many more from over 5500 partners across 1000+ cities in India.

- No Cost EMI financing up to Rs. 4 lakhs
- ・Instant activation on the Bajaj Finserv Wallet app
- A fully digital card
- Zero documentation
- A single card for your full family
- Flexible tenure up to 24 months

C. Electronic Prescription in Developed Countries: As indicated by the Finnish insights on drug items, an enlisted doctor composes a normal of in excess of 2000 prescriptions each year [8]. The appropriate administration

of medical treatment is important, since current strong medications are the reason for hospitalization in 10–16% of inward medication cases and about portion of those could be evaded [9, 10]. Additionally, the consumption on drug treatment has been becoming quicker than some other part of medical services in numerous nations [8, 10].

Table 1. Comparison of Electronic Prescription in Developed Countries [8].

Legal infrastructure	Selected countries				
	Denmark	Finland	Sweden	England	United States
Adoption of the electronic prescription law	-	✓*	-	✓	✓
Adoption of the prescription electronic transmission law	-	-	-	✓	✓
Issuing electronic prescriptions for controlled medicines	-	-	-	-	✓
Issuing a paper prescription if needed	-	-	✓	✓	-
Legality of the electronic signature of the prescriber	✓	✓‡	✓	✓	✓
Patient's satisfaction to participate in this service	-	Not required¶	-	It's required for selection of the pharmacy	-
Patient's satisfaction for stakeholders to access stakeholders to needed information	✓	✓	✓	✓	✓

*According to the law, electronic prescription for human consumption is authorized, ‡It is possible to use the "serial signature" for drugs prescribed within single visit, while each drug had to be (digitally) signed separately in the previous pilot, ¶Patients enter in this system by default, but if they do not want, they can reject the use of electronic prescription and receive paper prescription. Of course, initially it was mandatory to obtain patient satisfaction, √=Has the process, -=Has not the process

As per the current situation of covid-19 pandemic the rate of medical checkup and examination increase exponentially. So, this digitizing medical domain is helpful more than ever now, both for doctors and patients to maintain all the data.

Reserve funds in drug treatments would be conceivable if clinicians were better educated about the costs of various prescription choices. Automated recommending could give this data [10]. So that more needy patients can get medication at reasonable pricing.

D. Storage issue with *e*-prescription. Far more detestable than setting duty regarding the security of secret data with medical care experts is putting it with storage device administrators, which is the strategy that some ETP systems [11] Prescriptions are safely moved to a central store by means of an encoded transmission meeting and must be unscrambled utilizing a key known to the central storage device. They are then put away either transparently in clear content or in its scrambled structure. At long last, when a drug specialist or drug store demands them, remedies are taken out from capacity and either decoded and afterward re-encoded for the drug specialist or drug store (whenever put away in scrambled structure) or essentially re-encrypted for the drug specialist or drug store (if stored in the clear).

The results are that:

- Prescriptions will be in clear text during the decryption / re-encryption procedure, which could be for the storage's duration.
- Administrators could obtain the storage device's decryption key, thus rendering all prescriptions readable. Worse, they might have a dummy pharmacist's private key for administrative purposes, giving them access to all prescriptions.
- Patients retain their flexibility because they don't have to specify a pharmacist, but lose control of their data privacy while prescriptions are in transit.
- When equipment fails, patients cannot obtain their prescribed drugs.[3]

III. Conclusions

Privacy is essential to who we are as human beings, and we make decisions about it every single day. It gives us a space to be ourselves without judgment, allows us to think freely without discrimination, and is an important element of giving us control over who knows what about us. Hence, many different methods are out there in the world and all of these might work. This paper was a survey to have a glimpse of how different methods used in preserving the privacy of any user involved in the medical field.

From the two main methods we studied, Digital-health ID is more practical and flexible, it is currently being integrated into Apple ecosystem for Apple users to maintain their health via their watches and as we studied in the digital card system, we can provide separate encryption-decryption channel via VPN to maintain the privacy of the user.

We concluded that, in the current scenario of COVID-19 pandemic, if implemented this system around the globe, it could help patients as well as doctors to efficiently manage all their task and data.

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