Blockchain Project : Mediset

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1 Introduction

Mediset is a blockchain solution for creating, storing and accessing medical documents. The first version of Mediset focuses on writing medical prescriptions and verifying them. It allows doctors to fill out prescriptions online which are then stored on the blockchain. The prescription can only be accessed by the patient. Thus it protects the identity of both the doctor and the patient while increasing transparency in the sale of prescription drugs. Mediset works to incentise 3 parties to use the platform -

1. The Doctor : Using Mediset, doctors are assured their prescriptions are not used to obtain the same drugs multiple times, a real concern as e-pharmacies become more mainstream.
2. The Patient : The patient is assured that their prescription would not be misused by systems that will store their data and prescriptions and can use it in a variety of privacy invading or illicit ways.
3. The E-Pharmacy : Currently in India, E-Pharmacies employ verification of prescriptions such that they check for a doctor's stamp. Such a document can easily be forged or reused on multiple platforms.

As an added benefit, such a system can be used to track the amount of prescription drugs being manufactured and prescribed, thus can be used to analyse if they are being sold without prescriptions.

1.1 Background

The Indian Healthcare System has a complex interdependent infrastructure with patients, doctors, payers and multiple other stakeholders. Despite catering to billions of individuals, the healthcare ecosystem consists of disjointed databases, with no synchronous method of data keeping. The healthcare system especially lags behind in the integration of advanced technology within its existing systems and as a result, it lacks measures for data security, trust, interoperability and standardization. In the current infrastructure, seamless exchange of information

is challenging and thus, we look towards bitcoin to store medical records like prescriptions. Furthermore, immutability and verifiability can result in important health outcomes The following are the benefits of using blockchain technology to store prescriptions:

1. Storage of such electronic health records on the blockchain can enable various medical entities to exchange relevant information easily.
2. Cryptographic measures can be taken to ensure anonymity of a patient's personal information.
3. Since the blockchain is immutable, tampering with prescriptions is prevented.
4. Patients have ownership over their medical records

In the US, in 2015–2016, 45.8% of the U.S. population used prescription drugs in the past 30 days. Significant amount of therapy also takes place online, specially among students and young adults. Since such psychoactive drugs require prescriptions, issuing them online with accountability is important. Preventing using the same prescription on different platforms requires some transparency between various platforms. Thus blockchain technology can be leveraged here.

2 Project Goals

The goal of this project is to make sure prescriptions are spent by the right parties (while avoiding double spending) with approval from the required parties.

Mediset uses the Hyperledger Fabric to create a permission blockchain. It provides anonymity, security and decentralisation to all stakeholders. The ledger consists of a world state with data from the prescriptions and a blockchain with transactions that create and update the assets. The chaincode will allow to preserve all sensitive data. The chaincode offers some extra features to the doctor too -

1. Automatic Renewals : The prescription can be automatically renewed after a stipulated amount of time. For example - The doctor can set the renewal time to be 1 week. After the first prescription transaction is spent, another transaction is automatically placed that created a transaction which can only be spent after a week.
2. Expiry : The prescription can be given an expiry date after which the doctor might want to meet the patient for a follow-up.

Mediset uses a React Front-end to provide a seamless user interaction. The user interaction can be broken down into different types of users -

1. The Doctor : The doctor is provided with a UI in which they can simply scan the patient's QR code and prescribe medicine to them. After that, they can simply share the prescription via a URL with the patient.

2. The Patient : The patient can view their prescription using the URL. They can choose to spend it on an e-pharmacy or a pharmacy store.

   (a) Using the prescription at a physical store - The patient can simply scan the store's QR and make the purchase at a store. Once both the parties agree that the exchange has taken place, the transaction is marked as spent.

   (b) Using the prescription at an online pharmacy - As Mediset becomes more mainstream, patients will be able to directly place orders via Mediset such that their data remains private. They will only have to add a delivery address after which our APIs will place an order for them.

For version 1 of Mediset, we aim to create our backend application using Hyperledger and a front-end for the doctor to write a prescription and for a patient to view and spend their prescription.
Future goals include verification of doctors on Mediset, using a parser for physical prescriptions and tie ups with online pharmacy stores to allow a seamless experience. Finally, we can extend Mediset to include other medical documents too.

3 Implementation

We can think of the operations on the world state as follows -

1. Asset Creation : An asset is created using a transaction. The transaction takes the following shape :

Key	**Value**
Txn id	Asset = [Prescription, Who wrote, For whom, State = [Unspent/Spent]]

2. Asset Update : An asset is updated when the txn is 'spent' or a prescription is used to make a purchase online. A timeOut value can be used after which the state is again changed from 'spent' to 'unspent' so that the prescription can be used again. This will create a new transaction.

These are some of the functions that Mediset will implement:

1. createPrescription() - This function allows doctor to create a prescription
2. spendPrescription()- This function allows a patient to order medication online through spending the prescription online.
3. checkPrescription()- This function checks the status of a patient's prescription to see whether it is spent or unspent.

4 Benefits

There are several benefits to implementing Mediset -

1. Transparency about prescription drugs which are susceptible to misuse.
2. Actual verification of prescriptions in the online pharmacy space.
3. Anonymity of patients to ensure rightful ownership of data.
4. A distributed blockchain allows interoperability in a space occupied by various players.
5. A distributed blockchain also ensures transpracy between these players while ensuring reduced server costs and increased efficiency