**Problem:**

In India, one of the biggest challenges being faced by the healthcare sector is the storage of medical records. Many government-run hospitals still use the archaic paper-based methods to store records. Healthcare is not a one-time thing. Chances are over the span of your life you will visit a lot of hospitals and clinics. And without data, we’re picking up at the start, every single time, and it is completely inefficient. It exposes doctors to inadvertent mistakes, issuing the wrong medication, requesting the wrong tests and other such errors. Worst still, it endangers patients as well. They cannot be expected to remember every ailment or test or wellness routine prescribed to them. That forgetfulness leads to one of healthcare’s biggest problems, that of cost inefficiency.

Only private hospitals have computers and connectivity. The problem here is that every hospital uses its own Record Management System. Some store it locally while some store it on cloud services. Most of the time, your data is on a server that belongs to the hospital or is rented by the hospital. The problems with this model are fragmentation of medical records, lack of interoperability, inability to access data in emergency situations, manipulation of data by hospitals and unauthorized access by third parties.

The country lags behind other countries, such as Bangladesh and Sri Lanka, when it comes to the health of its people. The situation is worse for the poor as they cannot afford healthcare at high rates from private sector providers, which currently serve 78% of outpatients and 60% of inpatients.

This highlights the need for major reforms in the healthcare sector. Though information and communication technology (ICT) cannot work as a panacea, it can provide a cost-effective solution to improve the quality and coverage as demonstrated in other countries.

India has seen the benefits of ICT in transforming the lives of its people by the use of ICT in banking, railway reservations, public service delivery, etc. The same can be achieved in the healthcare sector too. The proliferation of mobile phones and the availability of high-speed Internet offer the possibilities to provide healthcare services in rural and remote areas of the country.

Public hospitals and dispensaries have very little ICT infrastructure. Only some major public hospitals, such as the All India Institute of Medical Sciences (AIIMS) and the Postgraduate Institute of Medical Education and Research (PGIMER), have computers and connectivity. The number of public healthcare facilities is quite large in the country; therefore, a large investment in hardware and software is required. To reduce expenses, it is necessary to use opensource software systems, mobile devices, and the cloud computing environment.

**Solution:**

The system that we are proposing makes it possible to store medical records on a public blockchain and cannot be tampered with or manipulated unless the patients give permissions to anyone explicitly.

The blockchain is an incorruptible digital ledger of transactions that can be programmed to record not just financial transactions but virtually everything of value.

Everyone on the network — the patients, the doctors, the insurance companies, the pharmacists first generate an RSA key pair to establish their identity. The private is securely stored locally on the device of the users and everyone on the network publishes their public key.

Whenever the patient goes to a hospital he provides authentication using his private key or biometrics. The hospital provides the required services and medical records of the patient are uploaded on the network. To ensure privacy, health records are encrypted using the public key of the patient. After this, only the owner of the record can access it and grant access to those who he/she wants to share the records with.

The network would be running as a Proof of Authority (PoA) chain. Proof-of-Authority is a replacement for Proof-of-Work, which can be used for private chain setups. It does not depend on nodes solving arbitrarily difficult mathematical problems, but instead uses a set of “authorities” - nodes that are explicitly allowed to create new blocks and secure the blockchain. The chain has to be signed off by the majority of authorities, in which case it becomes a part of the permanent record. This makes it easier to maintain a private chain and keep the block issuers accountable. A PoA chain is more secure, less compute intensive and more predictable. PoA deployments are used by the enterprise and by the public.

In our system, all the hospitals would take the role of authority nodes whereas all the other participants act as user nodes.

Every request to access records and every request granted are recorded as transactions in the blockchain network. In addition to this, every-time the insurance company, pharmacy or municipal corporation query on aggregate data is also recorded as a transaction ensuring transparency and non-repudiation. Storing EHRs on the blockchain would overload the network and increase latency so the records are stored on a decentralized file system IPFS which ensures that there is no single point of failure and redundancy.

All these small modules when combined together will effectively help to deliver medical services in cost-effective and efficient manner to Punekars and eventually to every citizen of India.