Electronic Health Record (EHR) is a digital record of a patient’s health information – it contains medical histories, treatment plans, and more. The EHR is essential in facilitating paperless health information that is easily shared and used by healthcare practitioners. However, current EHR systems are lacking in terms of privacy, security and data analytics – highlighting the need for a better, more complete solution that supports advanced predictive models.

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fragmented Health Records</strong></td>
<td>There are multiple EHR solutions in the market which are not compatible, leading to fragmented health records and information silos.</td>
</tr>
<tr>
<td><strong>Centralisation</strong></td>
<td>EHR solutions use centralised private or cloud-based servers which are vulnerable to a single point of failure (SPOF) and to hacking/denial of service.</td>
</tr>
<tr>
<td><strong>Lack Of Patient Ownership/Privacy</strong></td>
<td>Patients do not control access to their own health data and must rely on medical practitioners.</td>
</tr>
</tbody>
</table>

**MEDILOT’S SOLUTION**

**How it works?**

1. **Decentralised**
   - Based on distributed ledger technology, patients’ data is stored in different locations, eliminating the risk of a single catastrophic breach.

2. **Holistic**
   - Every patient will have access to a complete longitudinal health record: their own health story that they can access anytime, anywhere.

3. **Patient Centric**
   - The patient holds his/her own private key and has fine control over who can view their health records.

4. **Personalised**
   - Using an advanced analytics overlay (GEMINI), MediLOT allows for predictive models to guide treatment strategies for individual patient.

**Flowchart**

1. Request patient’s consent
2. Information entered in local EHR
3. Unique hash generated for every data entry and sent to blockchain
4. Access data through GEMINI
5. Check patient’s consent
6. Write consent
7. Approve/Reject data creation
8. Access data through GEMINI
9. Request patient’s consent

**Legend:**
- Data Generation Process
- Data Request Process

**Technology**

- **Analytics**
  - GEMINI: Short for Generalisable Medical Information aNalysis and Integration Platform, is the overlying AI suite that supports big data analytics and enhances clinical decision making.

- **Blockchain**
  - Hyperledger++: An enhanced Hyperledger with scalable consensus that improves throughput by 7 times.

- **Data Storage**
  - ForkBase: A Proprietary storage system with rich semantics, immutability and data sharing, built as a native storage system for Blockchain.

**The technology used in MediLOT has been developed over 5 years and published in more than...**

20 Peer reviewed scientific publications
Awards/Expertise
- China Computer Federation Overseas Outstanding Contributions Award 2016
- Singapore President Science Award 2011

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- AI Platforms  
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- Power Management  
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Partners

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GEMINI
GEMINI is a Generalisable Medical Information Analysis and Integration Platform. The objective is to design and implement an integrative healthcare analytics system to address various kinds of healthcare problems. The systems integrated in GEMINI cover data acquisition, data cleaning, data integration, data processing, data analytics and data visualisation steps of the big data analytics pipeline.

http://www.comp.nus.edu.sg/~dbsystem/gemini/

FORKBASE
ForkBase is a system that supports high-level properties demanded in many modern applications, including data versioning, collaboration and security. With its versatile programming interface, rich semantics and high performance, ForkBase enables rapid developments of many classes of scalable, distributed applications.

http://www.comp.nus.edu.sg/~dbsystem/forkbase/

BLOCKBENCH
BLOCKBENCH is the first evaluation framework for analysing private blockchains. It serves as a fair means of comparison for different platforms and enables deeper understanding of different system design choices. BLOCKBENCH measures overall and componentwise performance in terms of throughput, latency, scalability and fault-tolerance. Private chains, including Ethereum, Hyperledger Fabric, Parity and Quorum can be easily integrated to BLOCKBENCH via simple APIs to conduct comprehensive evaluation.

http://www.comp.nus.edu.sg/~dbsystem/blockbench/

APACHE SINGA
Apache SINGA is an Apache Incubating project for developing an open source machine learning library. It provides a flexible architecture for scalable distributed training, is extensible to run over a wide range of hardware, and has a focus on healthcare applications.

http://www.comp.nus.edu.sg/~dbsystem/singa/

HYPERLEDGER++
Hyperledger++ is an enhanced blockchain infrastructure of Hyperledger. It uses trusted hardware to improve trust relation between nodes and its throughput by a wide margin.

http://www.comp.nus.edu.sg/~dbsystem/hyperledger++/

FOODLG
Food(lg) is a food journaling, nutrition tracking and analytics app on the patient’s diet, by simply taking pictures of what the patient has eaten. Powered by a deep learning framework that learns the food type from image “pixels”, and based on standard nutritional guidelines and food composition data from the Health Promotion Board (HPB), Food(lg) calculates the patient’s daily nutrient estimates with the journaled entries for achieving a well-balanced diet.

http://www.foodlg.com/