EZ-Doctor

Medical Data Integrated Platform

WHITE PAPER

Contents

Abstract

There are many problems in the current medical system, such as unstandardized diagnosis and treatment, unbalanced resource allocation, poor communication of information, serious lack of curative effect evaluation system, which seriously restrict the sustainable, healthy and stable development of the whole industry.

At the same time, a large number of technology enterprises, scientific research institutes and social security institutions that want to participate in promoting medical development and optimizing medical experience have been unable to do so. The reason of "encirclement"of medical industry is that the traditional closed system causes the credit mechanism, circulation mechanism benefit distribution mechanism unreasonable or even missing.

Specifically, medical resources with high research value can not be used reasonably and properly, and the knowledge of medical diagnosis that exists in the minds of doctors is difficult to spread and share, which can effectively improve the quality of human life and enhance people's happiness, but for various reasons is regarded by the industry as an untouchable treasure.

By further study and research, EZ-Doctor has created the basic value system of the medical industry, clearly defined the three main value carriers of knowledge, data and computing power, put forward the "thinking projection" system to pave the way for ontology cognition and digital world transformation;to adopt blockchain and smart contract technology, build a value flow platform, design a dual track monetary economic system, and expand the level of medical value; to provide kinetic energy for each link of the medical industry chain, form a continuous flowing and expanding economic cycle system; around multiple links of the medical industry, establish a complete ecological system including the empowerment ecological layer and the innovation ecological layer, form the ecological attraction, and promote the transformation and upgrading of the medical industry into a new model and new business form.

Based on this EZ-Doctor put forward an open, transparent, efficient and sustainable development governance system to ensure the rational and fair interests of many parties and support its efficient and stable operation.

The birth and development of EZ-Doctor project not only provides a brand-new platform for the construction of medical industry credit system, but also reshapes the methods of medical knowledge acquisition and iteration, data exchange and sharing, so that every participant on the platform becomes a platform, through collaborative innovation and inspection practice, to promote the construction and development of the world medical system at a high speed, to provide greater momentum for improving the well-being of all mankind.

Terminology

Homogenization of global medical resources:
It is the average distribution characteristics of medical resources in different countries and regions of the world. Among them, medical resources refer to the sum of production factors that provide medical services, usually including personnel, beds, medical facilities and equipments, knowledge, skills and information, etc. Homogenization includes the following four meanings:

Supply-side homogenization:
Doctors or hospitals and other medical institutio-ns can provide medical services to more patients;

Demand-side homogenization:
patients are no longer affected by objective factors such as distance and region, forming a borderless flat medical environment;

Homogenization of medical knowledge:
a large amount of medical knowledge is shared without borders or differences, providing doctors with a lot of data or case support;

Homogenization of services:
Homogenization of medical services to provide patients experience;

Democratic medical care:
It is patient-centered. Patients actively participate in the medical process. Fully understand and master your own data and make judgments with doctors. It is a medical model to complete

National health coverage:
National health coverage is a concept proposed by the United Nations in 2013. Its goal is to ensure that all people have access to the health services that they need without great economic risk or risk of poverty.

Medical data interoperability:
Two or more different medical information systems or system modules can effectively exchange data, and use the exchanged data for meaningful use.

Large-scale medical research collaboration:
Globally, more institutions and individuals can participate in the collaboration of medical research through the sharing and exchange of medical data and medical knowledge.

Stepped invisible data exchange:
Different medical data have different weight in privacy protection. According to the sensitivity and security requirements of medical data information, medical data can be exchanged by different cryptography and other technical means. Meanwhile, it can ensure that the exchanged data is available but not visible to the data users in the exchange process.

Thinking projection:
Based on cognitive computing, constructing a mapping bridge from ontological cognition to the digital world, to implement medical knowledge execution, communication,reasoning, decision making, planning learning, reflection, supervision and other high level behaviors;
Support the self evolution of medical knowledge thinking projection, so that more high-value medical knowledge is widely used.

Computation of medical knowledge:
Using medical intelligence technology based on cognitive computing, following clinical practice evidence, using computer description language, extracting the doctor's knowledge into an automatically executed contract, that is, the process of medical knowledge computation.

Tolerance data cleaning:

To remove tolerance duplicate data or invalid data to ensure data consistency, ensure its integrity and accuracy, and improve data quality. Tolerance data has different meanings for different data structures. For text data, it refers to data with the same semantics; for unstructured data such as images/videos. It refers to changing the encoding format or resolution, rotation, and other image/video data with embedded watermark or text.

Hexahedral data type:

It is a unified data model of unstructured data, which can express unstructured medical data such as image, audio, video, text, etc. The model uses six facets to describe the elements of unstructured data, and describe the internal connections between these elements, among which six facets respectively describe the basic attributes, semantic features, data features, exchange features, dynamic features, and raw data.

PROforma:

It is a development environment that supports knowledge, cognitive models, and description languages for decision making systems. It has developed to the second generation. Through mathematical expression, it provides a complete set of operating tools for designing, testing, and formulating medical procedures to support doctors in editing and using clinical decision support and assistance systems.

Interactive smart contracts:

To fit medicine inquiry, screening, diagnosis, treatment diagnosis, treatment and rehabilitation processes in diagnosis and treatment system, EZ-Doctor adopts the execution method of the middle layer, which not only makes the smart contract compatible with more design languages, but also enables the smart contract to have interactive capabilities, so that the computation knowledge can get a good expression, and be more in line with the needs of the medical industry.

Super nodes:

In order to complete decentralized data, efficient and reliable exchange of computing power and algorithms, EZ-Doctor has designed super nodes, including data super nodes, computing super nodes, algorithm super nodes and audit super nodes. Among them, the data super node provides the blockchain with a decentralized super database to ensure efficient data access on the blockchain; the computing power super node provides the block chain with a non-centralized super computer for carrying efficient distributed computing power demand; The algorithm super node provides the blockchain with a knowledgeable super virtual machine to complete the valuable exchange of knowledge while ensuring data security. The audit super node provides a virtual specialist for medical data audit for the blockchain to ensure the data in the data exchange process.

Quality empowerment ecology layer:

It is the first circle layer of EZ-Doctor ecology, which can open the data layer and empower the medical industry, so that digital assets can flow freely.

Innovative ecology layer:

It is the second circle layer of EZ-Doctor ecology, which can stimulate the development, application and promotion of DApps in various medical business fields, promote the continuous innovation of medical industry business and finally reshape the business model of medical industry.

Background

Health right is a basic human right. As a basic public service, medical service has a very simple action goal: everyone, no matter where they are, can get decent and effective medical care without falling into economic difficulties. However, the report of the World Health Organization (WHO) and the world bank in 2017 [1] [2] shows the worrying situation in the distribution of medical resources and the accessibility of medical services in the world.

- Half of the world 's 7.3 billion people have no access to basic health services.
- The world faces a shortage of approximately 12.9 million medical practitioners.
- There are 323 doctors and 41.7 nurses per 10,000 people in Europe. In Africa, there are only 24 doctors and 10.7 nurses per 10,000 people.In sub-Saharan Africa, the situation in Africa and Southeast Asia is even worse.
- In low-income and low-middle-income countries, the necessary maternal and child health intervention services received by the wealthiest mothers and babies are 4.5 times the services available to the poorest mothers and babies.
- Every second, 3 people fall into extreme poverty due to payment of medical expenses. Each year 800 million people face serious financial difficulties due to health expenditures.

Due to the imbalance of medical resources distribution and quality,the right to health has become an extremely unequal right. Millions of people have difficulty in getting medical services or the medical services are expensive and of poor quality.

In the face of the imbalance of global medical development, medical big data and artificial intelligence(AI) technology are expected. However, according to McKinsey's assessment report, the application of big data in the medical industry lags behind other industries, achieving only 10% and 20% of its potential value. In the United States, which is the most advanced in the development of medical information, only 8% of the electronic medical records have been used, and the vast majority of the medical big data application goals set by it have failed. As a relatively closed and conservative old industry, the particularity of medical industry has led to many problems and challenges in the development of medical data boosting industry.

1 The contradiction between big data completeness requirements and medical data fragmentation

Compared with other industries, the medical industry has a very high demand for data integrity. The definition of medical big data basically covers a person's whole life cycle, including individual health status, living habits, diagnosis and treatment behavior, genetic information, mental health, environmental factor data, etc. However, the vast majority of global medical data are scattered in various medical institutions or relevant departments in the form of "data island". It is difficult to exchange and share data effectively between different medical institutions and other related institutions. For example, the data of government insurance companies, pharmaceutical companies and medical equipment suppliers are isolated from each other and cannot be effectively integrated, which leads to the lack of medical data integrity.

2 The composition of data ownership is complex and data privacy lacks of effective protection

There are many sources of medical data, with multiple contributions of knowledge and wisdom, and its ownership structure and its complexity are not easy to divide. At the same time, under the over centralized medical data management model, lack of tracking and control of the use of medical data, it is easy to misuse personal privacy data, or even tamper with patient medical records or diagnostic records. At the same time, the security of traditional storage methods is not good. If there is a problem in one link, data security is challenged, resulting in the disclosure of personal privacy medical data.

3 Explosive growth of medical knowledge; Difficult to share and flow deeply

The explosive growth of medical knowled-ge and data has surpassed the processing power of the human brain, making it difficult for doctors to synthesize all relevant information to make decisions on diagnosis and treatment plans. At the same time, static medical knowledge has a long accumulation time, it is difficult to extract after it is formed, and it is more difficult to capitalize for full sharing and flow. This has further exacerbated regional differences in medical care levels due to uneven distribution on of resources. In addition, because there is no corresponding supporting technology, after the formation of medical knowledge in one direction, it is difficult for other medical practitioners to participate and integrate their own knowledge, so as to achieve self improvement of the medical knowledge system.

With the development of the times and technological progress, the emergence of blockchain and smart contract technology has brought new perspectives and ideas for the reliable exchange, assetization and deep sharing of medical data, and efficiently realization the interconnection of medical resources and medical data. The blockchain establishes an objective and non-tamperable medical data use tracking and control mechanism from the technical level to build a medical data use credit and medical knowledge flow platform; at the same time, smart contract technology promotes the flow and sharing of medical knowledge through the realization of medical knowledge calculation, shrinking medical gaps between regions. Using a new generation of information technology to trigger a new round of human pursuit of health, wellbeing and quality of life has become the second information technology revolution in the medical field.

The EZ-Doctor platform aims at the pain points in the industry such as trusted exchange and sharing of medical data and visual medical knowledge exchange and sharing, and uses data from various medical institutions as nodes to achieve the safe exchange of medical data, price sharing and controlled dissemination.

The EZ-Doctor platform is based on the technical system, distinguishes the ownership, use and execution rights of medical data, and forms and verifies smart contracts in a formal way to realize the trusted exchange of data and the sharing of visual medical knowledge. Driven by business applications, it has broken the boundaries between the medical systems of different medical institutions and different countries, and improved the overall global medical level. With the incentive of economic system, we will promote the access platforms of various organizations and traditional medical information systems, such as Internet of things health equipment, and maintain the healthy and orderly operation of the platform. With the promotion of ecosystem, we can fully explore the value of multi-source and heterogeneous resources, and provide an organic growth environment for the storage, exchange and value upgrading of knowledge. At the same time, with the help of a strong core team and fund organization, the platform will be implemented and developed in an orderly manner.

Targets

Medical big data is an important basic strategic resource and an important attempt to solve the current medical problems. There is no denying that the medical industry has always been a data intensive industry. In this ecological environment, almost all diagnosis and processing can generate data. At the same time, the diagnosis of the disease also needs to be supported by a large number of long-term scientific theoretical exploration and practical tests. So it is the best way for doctors to learn from medical records, which is also the original intention of the birth of evidence-based medicine. Under the cross integration of medicine and information science in the past decades, from medical information to the big data driven precision medicine, information technology is promoting the innovation of medical methods and medical data has actually become a new production factor.

In the upsurge of medical information and big data, the big data of medical health from complex high-resolution medical imaging data to simple real-time medical data from smart wearable devices, all kinds of multi-source heterogeneous medical health big data are growing rapidly, and the field of medical health has become one of the fastest growing fields of data, It is huge in size and complex in type, which produces real-time digital images of human medical treatment, and it has a tremendous impact on disease prevention and control, drug development, and the tackling of persistent diseases around the world.

EZ-Doctor adopts the form of formal creation, verification and execution of smart contracts to realize the visualization sharing, interaction and usage tracking of medical knowledge to ensure the credible sharing of medical knowledge throughout its life cycle.

EZ-Doctor organically generates the medical industry knowledge and doctor's professional medical experience, disease diagnosis and treatment process, and generates a visual smart contract with semantic information to support the diagnosis decision of other doctors and medical institutions. In this way, the flow and dissemination of medical big data and medical knowledge are greatly promoted, the value of medical data is infinitely enlarged, and the problem of imbalance of global medical resources is fully solved.

EZ-Doctor provides a reliable, safe, easy to share, perfect audit and flexible billing mechanism for doctors to use case data, diagnosis results, peer knowledge and other data to complete diagnosis and treatment services. In order to better protect patients' privacy information and data security of medical institutions, EZ-Doctor has developed a complete privacy protection mechanism and audit tracking process; at the same time, for difficult cases, it can accept the diagnosis from authoritative doctors from all sides, and pay directly to the doctors with the best treatment plan according to the diagnosis and treatment effect, so that the platform's diagnosis and treatment objects and knowledge contributors can get the maximum benefit, maintain the sustainable development of the platform, and achieve three-win effect.

Technology System

Based on the blockchain, EZ-Doctor is designed and implemented for medical treatment with a new smart contract architecture. Based on the core task of data exchange and promoting the flow of medical knowledge, the trusted technology platform has been constructed for medical industry which innovatively realizes the trusted exchange and processing of data by all parties in the medical industry without affecting the ownership of data, enables sensitive data to flow fully under strict protection, and enlarges the value of data infinitely, so as to realize global medical resources homogenization.

Design concept

In order to maximize the value of medical data and knowledge, the design principles and design ideas of the EZ-Doctor platform were determined, and the overall technical architecture of the platform was constructed.

Design Principles

Data flow and sharing is the foundation of the development of the data industry, but due to the particularity of the data itself and the current data transaction mode mechanism is not perfect, the current data transaction progress is slow. The data exchange blockchain can promote the safe and effective flow of data between the two parties of the transaction, and ensure the legal rights and interests of the data provider, and realize the management and monitoring of the flowing data.

- **Protect the rights and interests of data assets of medical and health institutions**

The birth of blockchain technology has changed the centralized storage of medical data. Through the structure that the organization completes the authority review and data verification, a new model can be achieved that can remove intermediate institutions, increase data security, and save time and cost. It is necessary to protect the rights and interests of the owners while sharing.

- **Ensure the long-term and healthy development of the data sharing chain**

The blockchain's own transaction quantization mechanism allows data users and owners to take their own needs and form the initial exchange momentum. In order to ensure its long term healthy development, the platform technically implements an incentive mechanism for data exchange to keep nodes and data active.

- **To ensure the effective and rapid flow of medical expert knowledge**

Through the analysis and mining of big data in the medical and health fields, important medical knowledge evidence about disease and health is obtained. On the basis of breaking the traditional knowledge form, it is integrated into the smart contract, and its rapid circulation is promoted by blockchain technology.

Design Ideas

In order to ensure the design purpose of the platform, the design idea of the technical system is mainly based on the following points on the premise of the following design principles.

● Universal assetization of data and resources

Data assets are data resources owned or controlled by an enterprise or organization that can bring future economic benefits. Not all data are assets and only controllable, measurable, and realizable data can become assets. The process of realizing the realizable attributes of data assets and reflecting the value of data,that is, "data assetization". At the same time, the storage, computing power,knowledge, etc, of an enterprise or organization can be capitalized to realize its value on the platform.

● Reliable exchange of data and resources

In the recognition of data value, in the business model with data production as the core, data or information rental and sale will have a broad market space. Under the guidance of platform trading rules and pricing standards, the flow of data assets will be realized. With the construction of data transactions and the improvement of security, the process of data and resource assets transactions will be accelerated.

● Computability and enforceability of medical knowledge

Use formal smart contracts based on cognitive computing to fully solve the problem of collaborative computing of medical sensitive data. and the integration of heterogeneous resources, so that medical knowledge is like "score", recordable, computable, executable, and available. The application of blockchain technology in the medical industry opens up a brand new solution path.

Technology framework

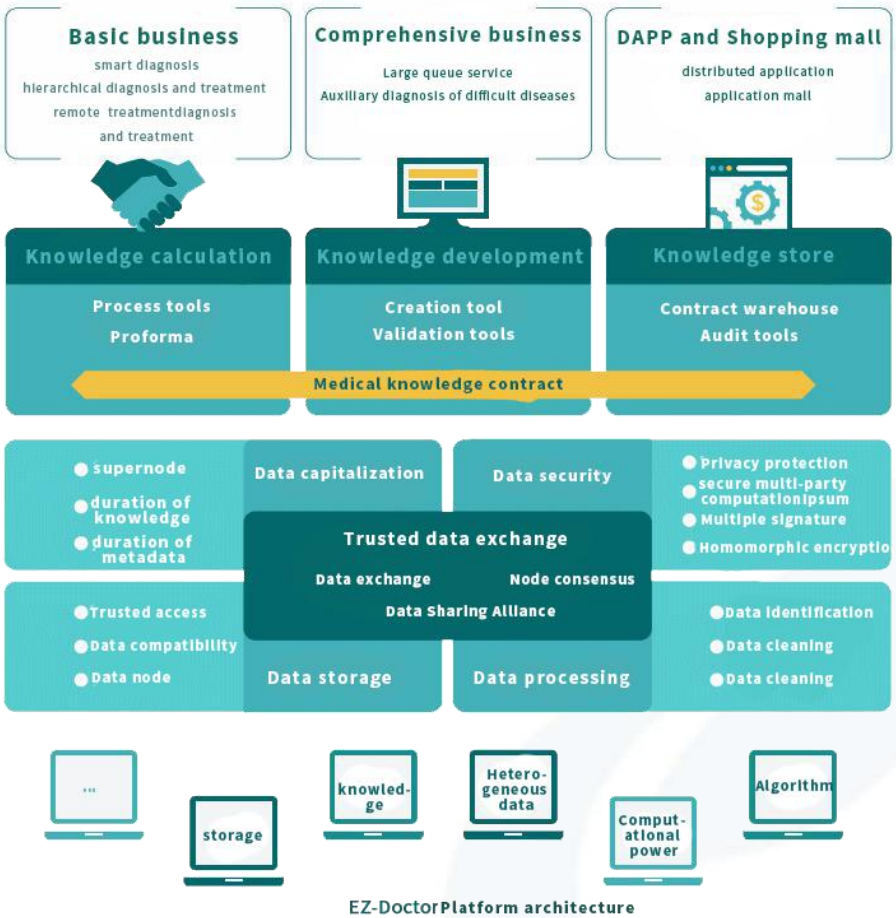
EZ-Doctor platform accesses multi-source heterogeneous medical and health data, providing fast delivery for medical institutions, experts, and patients.

Heterogeneous data refers to the medical and health data of each system connected to the platform according to their characteristics. The effective use and analysis of these data, mining the hidden information, can provide better support for medical health management. How to select high-quality data from the massive multi-source heterogeneous data generated in the process of hospital informatization is the first problem of medical and health data mining analysis. EZ-Doctor uses the concept of thinking projection to build a bridge between the real world and the digital world to realize the definition, storage, transfer and conversion of resources and assets on the value Internet, thereby promoting the integration of value Internet services and traditional Internet services.

Chain-based data assetization, data processing, data storage, data interaction and data security are the technical core of the entire platform. EZ-Doctor attempts to make breakthroughs in several core issues of blockchain consensus algorithm, ecological topology, value network protocol, collaborative fusion computing, and upper layer application ecology, and strives to promote the wider application of blockchain and value Internet.

Data processing takes tens of thousands of medical data produced in the medical process as the object. According to the characteristics of big data and massive unstructured data of medical and health, data processing and decision making process is designed to effectively store, search and analyze them. Data capitalization establishes a data capitalization system in line with its own business and data characteristics, and closely links with business. In the process of data capitalization combined with business applications, the platform not only keeps and increases the value of data, but also brings huge economic and social benefits. Data security protection refers to the security functions provided by the platform to support data flow security, including data classification, data encryption, privacy protection and other contents, strengthening data isolation and fine-gained access control, and realizing core requirements such as"available and invisible" data.

The blockchain based smart contract includes transaction processing and saving mechanism, as well as a complete state mechanism, which is used to accept and process all kinds of smart contracts, and completes the transaction saving and state processing. In the self-growing ecological environment of smart contracts, through the programmable way of blockchain smart contracts, the contract library can generate application value. Encourage developers to create a better contract library, and at the same time, reduce the difficulty of industrial application landing. Using the visualized smart contract platform to provide doctors and experts with the means to formalize the diagnosis process and medical knowledge.



EZ-DoctorPlatform architecture

Chain Technology

EZ-Doctor is a distributed medical data platform that meets the requirements of high reliability, ease of use, and security of medical data, and at the same time realizes the effective use of medical data. The medical knowledge sharing ecology established by EZ-Doctor is based on blockchain technology,and exerts its advantages in data privacy protection and data storage.

Chain function

EZ-Doctor builds a global medical resource sharing platform based on the blockchain. While using the new blockchain technology, it fully considers its usage scenarios and deals with current and predictable problems in a multi-chain form in the project.

Clearing and settlement chain

In essence, blockchain technology is a technical solution that does not rely on third parties and uses its own distributed nodes to store, verify, transfer, and communicate network data. Therefore, from the perspective of financial accounting, blockchain technology can be regarded as a distributed and open decentralized large network bookkeeping book. Anyone can use the same technical standards to add their own information at any time. The blockchain continues to meet the data entry needs brought about by various needs. The expansion of the distributed clearing mechanism brought by blockchain technology, such as the clearing among the entities in the EZ-Doctor system, can reduce the management cost and improve the efficiency of clearing. In traditional counterparties, each transaction needs to be recorded in the bank, and also needs to be cleared and reconciled with the counterparty resulting in slow speed and high cost.The payment through block chain technology is directly completed by both parties of the transaction, and does not involve intermediate institution, even if some nodes in the network are paralyzed, it will not affect the operation of the entire system. Based on the blockchain technology, a set of universal distributed transaction protocols are built to provide global and real time payment and clearing services for accessing participants, making payment convenient and low cost.

EZ-Doctor supports the payment behavior in the process of data exchange and knowledge sharing in the form of blockchain, and needs to support stable coins. One of the tasks of EZ-Doctor is to productize knowledge, help knowledge producers transform knowledge into products and services that users are willing to pay, and provide value to users. Only when knowledge has been turned into products or service that can help users solve problems, transfer value, set price and sell.

EZ-Doctor longitudinally considers the value transfer process of knowledge and data, and the clearing and settlement chain complete the payment, settlement and clearing process in a concise and efficient manner.

Index Chain

The development of blockchain applications is-more based on the use of its decentralized and non-tamperable technologies. These two characteristics successfully push blockchain application technology to the world.

In the Internet world, huge amounts of user data have been stored on the servers of third-party platforms.These user data assets have increased the market value of the platform, but users have not got the benefits.

As a kind of value network, blockchain data will be defined as assets because of the existence of demand.

The best thing about blockchain is to build an ecosystem, because its incentive mechanism allows everyone to actively participate. Individuals are creating data in different ways, and these data will be fed back to individuals in the form of assets. EZ-Doctor uses the index chain to build this ecology. The index chain completely records the data assets contributed by any organization or individual, and shares these data in a trusted manner, thereby benefiting contributors.

The index chain stores data assets in the form of meta-data. Meta-data is data describing information resources or data, and its purpose is to identify resources, evaluate resources,track changes in the use of resources,achieve simple and efficient management of large amounts of networked data, and realize effective discovery of information resources, search and integrate organizations and manage resources effectively.

Keep the meta-data in the block and ensure the integrity of the meta-data through collaborative verification. It can be divided into two stages, the meta-data storage stage and the meta-data verification stage. In the meta-data storage stage, the user's signature and copy location data are sent to several verification nodes to generate meta-data blocks and write them into the meta-data blockchain. In the meta-data verification stage, the verification node first checks whether the state of the local meta-data is the same as the global state, and if it is not the same,it synchronizes the state, then retrieves the local meta-data blockchain to verify meta-data integrity.

In the index chain, in order to solve problems that users can find the required data information efficiently and quickly, an integrated management and retrieval system based on meta-data is proposed, which includes three links: meta-data information extraction, meta data weighted index, and meta-data attribute extended retrieval. Combined with the professional knowledge in the medical field and the actual needs of users, design the attribute-based shared meta-data table structure and retrieval query method to improve the accurate retrieval rate and recall rate.

Business chain

The blockchain establishes a decentralized consensus mechanism. This consensus mechnism combines digital encryption and game theory, so that participants can form a mutually trusted credible environment without any external mandatory constraints. This credible environment removes the need for centralized external control of authorization, and is even based on mutual distrust, so this decentralized and trusted block chain architecture solves this credit and governance issues in the virtual and anonymous online world. The healthcare industry is undergoing a major transformation. The digitization of medicines(therapies), equipment, services, and business models has promoted the democratization of the current healthcare system, unleashing new value by replacing high cost controllers, and opening up areas that were previously unavailable.

Most countries have formulated policies or strategies that target digital healthcare, greatly increasing the use of digital health records(EHR /EMR)and other health information technology (HIT) systems or infrastructure.

However, there are still many restrictions on the security, integrity and access control of personal health data, which has caused great bottlenecks in the innovation of nursing services. When the medical industry struggles to balance the risks and rewards, the potential application of blockchain technology provides a timely solution to alleviate these urgent needs. The combination of blockchain and medical meet the technical needs to support the trend of other complex application scenarios other than pure digital information technology. The processing of electronic medical data is one of the current hot research areas of blockchain.

However, the pain point of medical data sharing mainly lies in the privacy protection of patient's sensitive information and the safe sharing of data by multiple parties.

EZ-Doctor is to create a targeted business chain based on blockchain and bring innovative ideas for medical data sharing. EZ-Doctor's business chain realizes the digital democratization of the medical service model based on value. Medical providers can make better use of health information technology standards and improve medical interoperability. At present, the new vision of the medical industry is not only about medical access, quality and affordability, it is also about promoting social, financial and inclusive prediction, prevention and outcome oriented care models. With the emergence of more and more regulatory obstacles and global pressure to reduce medical costs. Blockchain technology is expected to unblock new economic advantages by automating transaction services in medical work flows (such as claims determination, bill management, revenue cycle management, pharmaceutical supply chains, and other medical subcontracting processes, etc.) by replacing high cost controllers.

Technology Selection

Blockchain is a decentralized ledger technology. It needs to be open, autonomous, and non-tamperable. Decentralization refers to the use of distributed accounting and storage. There is no centralized hardware or management organization. The rights and obligations of any node are equal. The data blocks in the system are jointly maintained by nodes with maintenance functions in the entire system. In other words, any node in the system needs to fully calculate and store the transaction data. Therefore, the blockchain is not scalable, that is, the overall performance of the system is limited to the upper limit of the performance of a single node, even if a large number of nodes are added. The overall performance of the system cannot be improved.

Scalability is a basic characteristic of traditional distributed systems, but due to the decentralized requirements of blockchain, scalability is difficult to meet. The industry has summarized a ternary paradox describing the contradiction between decentralization and scalability. It has not been strictly proved and can only be called a conjecture, but in the actual system design process, it is always challenged by: The three attributes of centralization, security, and scalability can not be satisfied at the same time, and only two of them can be considered at most.

The main factors that affect the performance of blockchain transactions include several mechanisms such as consensus mechanism, transaction verification, broadcast communication, and information encryption and decryption. Starting from these links, we can get some methods to improve performance, and optimization methods for different scenarios. EZ-Doctor adopts multiple chains to form payment settlement, data catalog, business processing, etc, namely settle-ment chain, index chain, and business chain.

The three chains face the actual situation encountered in EZ-Doctor. Different chains carry different application requirements, and on this basis, the medical value Internet is realized.

Off-chain Super Nodes

The decentralized application brought by the blockchain also brings many new challenges, such as the use of the blockchain to manage the continuous growth of the data. Even the medical and health information data (raw data that does not involve personal privacy) is massive and it will consume more space and time.

EZ-Doctor supports various off-chain super nodes to complete a large number of efficient and trusted exchanges of decentralized data, computing power, and algorithms.

When decentralized storage uses some of the characteristics of the blockchain, we also have to rethink about how the data is stored on the blockchain, such as the use of Shardlng, Swarming and other technologies. The data super node provides a decentralized super database for the blockchain to ensure the application of high efficiency data access on the blockchain; the computing power super node provides the decentralized super computer for the blockchain to be used for efficient and distributed computation power requirements; algorithmic super nodes provide the blockchain with a knowledgeable and super virtual machine to complete the valuable exchange of knowledge while ensuring the security of the data; the audit super nodes provide the blockchain with a virtual data audit specialist to ensure data quality in the process of data exchange.

The blockchain with super nodes improves operating efficiency. Although compared with the number of blockchain nodes, the number of super nodes is not large, and some of the "decentralized" part are sacrificed, but it will not cause the disadvantages of centralization. When any super node does not abide by the rules of the public chain, it will be rejected and replaced by a democratic vote.

The computing power center comprehensively configures data super nodes, computing power super nodes, algorithm super nodes, and audit super nodes with resource advantages. The computing power center is a centralized global computing power resource sharing platform that can provide data exchange, data calculation and security services, and provide computing power resources for safe and reliable medical distributed computing and high performance computing.

With the surge of medical data volume and the complication of medical models, it is not enough for individual users to rely solely on their own computing power or data.

No matter from a technical point of view, or from the consumption of resources, the demand for data and the demand for equipment hardware, ordinary users are discouraged. The computing power center aims to lower the threshold for ordinary users, purchase computing power through the EZ-Doctor platform, and use the technical means of computing power fusion to obtain reliable medical data or calculation results. Based on the computing power of individual users and business users, EZ-Doctor will continue to open up new computing resources to the world, improve user data exchange and data computing experience, and create greater value with less resource consumption. At the same time, in order to better serve users, it will rely on partners and professional teams from around the world to deploy a computing power center around the world to ensure that computing power investors obtain stable income with minimal investment.

Data Processing

We build a high performance data processing architecture based on dynamic configurable pipeline and general medical industry data standards to achieve tolerance deduplication of multi-source heterogeneous data from different entities such as hospitals, medical institutions, community medical centers, Internet of Things, personal sign testing devices and portable medical devices, thereby improving data processing efficiency and providing a total high-quality data support for the medical industry to accurately land.

Tolerance Data Cleaning

Data cleaning removes duplicate invalid data or corrects error information, thereby ensuring data consistency, ensuring its integrity and accuracy, and improving data quality. In view of the large amount of repeated invalid data in medical data, MD5 message digest algorithm is used to identify completely repeated data first, and then the local sensitive Hash function is used to perform tolerance deduplication on the remaining data.

The MD5 message digest algorithm [3] (hereinafter referred to as MD5) is a cryptographic hash function developed by Rivest in 1991. Any input can produce a 128-bit hash value. Even if the input is only 1 bit different, the output hash value will vary greatly. Taking different medical data as the input value of MD5, and judging whether the input value is duplicated data by comparing whether the output hash value is the same, so as to realize the deduplication of medical data. The MD5 algorithm has high deduplication efficiency, but it can only deduplicate completely duplicated data.

Locally sensitive hash function [4] [5] is a hashing method that has a higher probability of hash values obtained from similar input values. Using local sensitive hash function can achieve tolerance deduplication, such as for text data, it can be identified based on semantic repetitive data; for unstructured data such as images/videos, it is possible to identify tolerance repetitive data when changing the encoding format or resolution, rotating, embedded watermarks or text.

Medical data identification

Data identification is to use data to identify data,so that computers can distinguish different information contained in the same appearance data generated in different environments,so as to realize the accurate application of big data. At present, the international classification of diseases (ICD) is an international unified disease classification method formulated by WHO. According to the etiology, pathology, clinical manifestations and anatomical location of diseases, ICD classifies the diseases into an orderly combination, which is represented by coding method.

At present, the 10th revised "International Statistical Classification of Diseases and Related Health Problems", that is ICD-10. DICOM (Digital Imaging and Communication of Medicine) standards are jointly developed by the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) to regulate digitalization The standard for the exchange, storage and display of medical images and related information is DICOM3.0. The medical digital imaging and communication standards establish a standardized data structure and a complete data model, which can enable the complete expression of medical imaging information and effectively promote the archiving of medical imaging information.

EZ-Doctor combines ICD-10, DICOM3.0, SNOMED-CT(Systematized Nomenclature of Medicine- Clinical Terms) and other international standards and specifications, following the basic rules of science, uniqueness, scalability and simplicity, and The data is scientifically and completely classified, and the structure of the data identification coding standard is established, and specific data coding rules are formulated. the code structure is adapted to the classification system, and the same hierarchical relationship is also reflected through the code when coding.

Hexahedral data model

In order to improve the unified storage and processing of many unstructured data in medical data, locate the original data and synchronize the changes of the original data, and realize the exchange and sharing of medical data of the specified information, it is necessary to describe the original data from various dimensions, refer to the tetrahedral data model [6] proposed by Li Wei etc EZ-Doctor proposed a hexahedral data model to describe unstructured medical data such as images, audio, video, and text. The model uses six facets to describe the constituent elements of unstructured data and to describe the internal relationships between these elements.

Hexahedral data model is a kind of unified data model of unstructured data, which can express unstructured medical data such as image, audio, video and text in a unified way, and can comprehensively desc-ribe the basic attributes, semantic features, data feature, exchange features, dynamic features and original data. Unstructured medical data can be composed of six facets of hexahedral data model, of which-six facets are:

(1) Basic attributes: used to describe the basic characteristics of original medical data, such as name, description, classification, data category, data sub-category, data storage size, data volume, creator, creation time, etc.

(2) Semantic features: used to describe the semantics of the original data, including semantic elements such as creation intention, data subject description, and underlying feature meaning, used for data retrieval, semantic matching, etc.

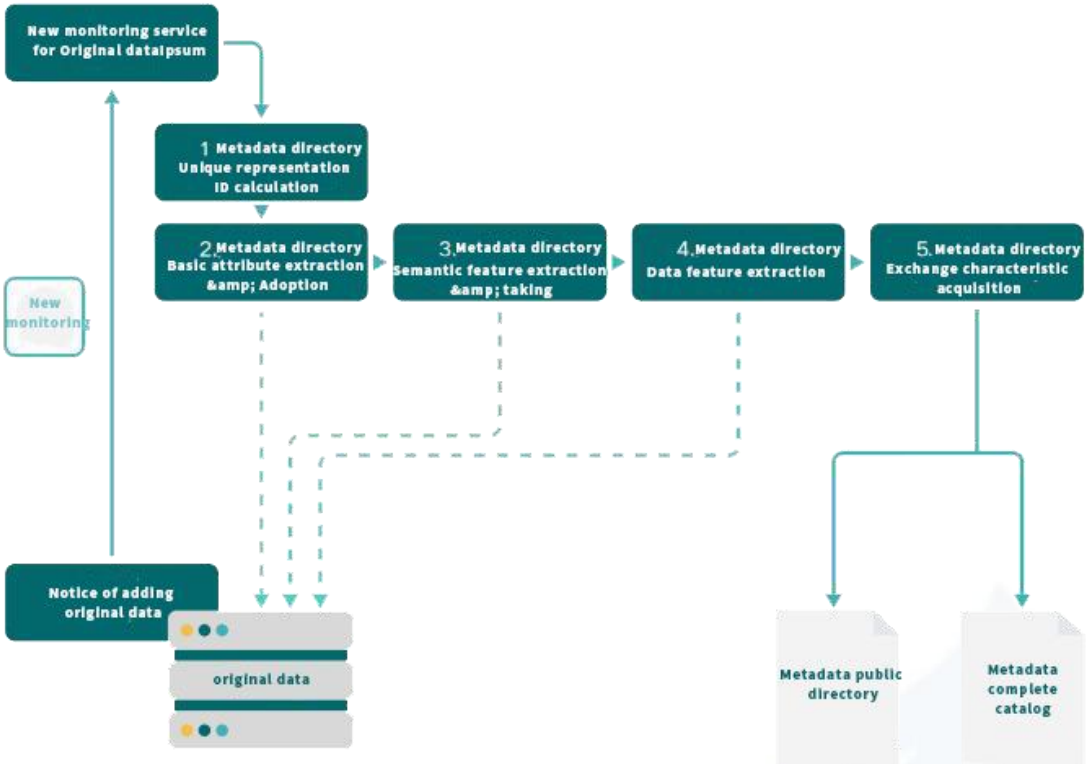
(3) Data characteristics: used to describe the unique data characteristics of the original data.

(4) Exchange characteristics: used to describe the attributes related to the data exchange of the original data, mainly including ownership description, data exchange restrictive condition description, distribution condition, use condition, charging method, price condition and time condition.

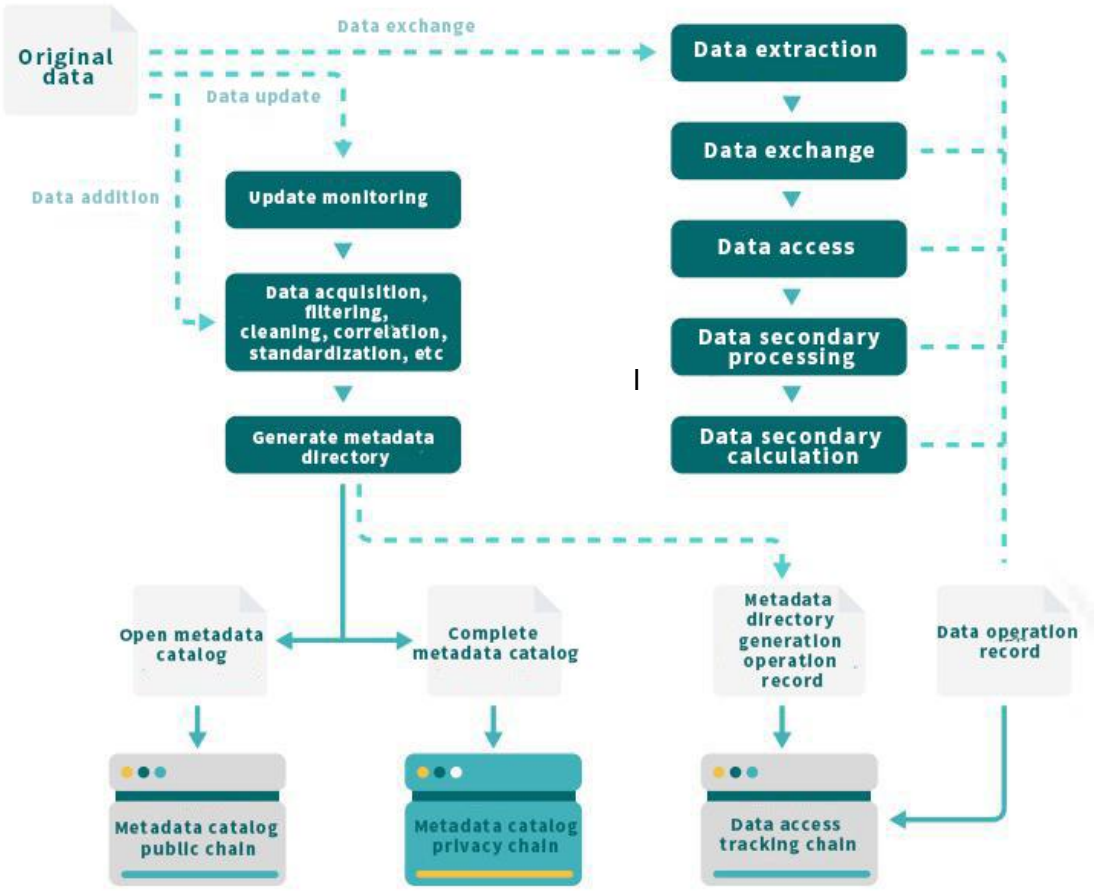
(5) Dynamic features: The original data catalog (also called; meta-data catalog) can be formed through basic attributes, semantic features, data features, and exchange features. Dynamic features are used to describe the extraction, synchronization, and storage mech-anisms of the data catalog. Among them, the data catalog extraction mechanism is the process of generating the meta-data catalog, that is, the process of filtering, extracting, cleaning, associating, and standardizing the original data; the data catalog updating mechanism is the process of synchronizing the meta-data catalog after the original data is changed, namely monitoring the changes of the original data, and synchronizing the meta-data catalog for the original data changes in time;

The storage mechanism is that the meta-data index is divided into a public meta-data index chain and a privacy meta-data index chain according to the confidentiality granularity. The public meta-data directory chain is a public, non-private meta-data directory description chain; the private meta-data index chain is a non-public, sensitive, privacy involved meta-data index description chain, which is a meta-data description that controls access to data exchange processes for smart contracts. It also contains a chain of data creation, exchange transfer, viewing, processing, calculation and other access to trace information.

(6) Original data: original ecological file of unstructured data.



Metadata catalog extraction flow chart



Metadata directory storage mechanism diagramIpsum

Data Audit:

In order to improve the amount of medical data, EZ-Doctor data audit node adopts the method of data audit contract to conduct regular audit of data owned by data provide-rs, and constructs the effective impact of data audit results on data value, so as to encour-age data owners to complete data audit, impr-ove data value and data quality, and provide accurate data guarantee for medical applicat-ions.

Data audit can be divided into three levels: audit based on the experience of audit experts and audit techniques of regular audit analysis, audit based on audit analysis model and multi-dimensional data analysis technology, and audit based on data mining technology. For different medical data, EZ-Doctor has developed different levels of audit methods to achieve a comprehensive and granular review of medical data.

EZ-Doctor data audit method is not a separate one, it is usually a combination of multiple methods, such as statistical analysis techniques to detect deviations, correlation analysis techniques to reveal key attributes, isolation analysis techniques to uncover audit suspicions, clustering analysis techniques to determine audit focus, etc.

Data Safety

The privacy protection of medical data is the premise of realizing data fusion, sharing and open application. Only when the security is ensured can the medical industry develop healthily and orderly. Focusing on the protecti-on of core medical data, this platform constructs a classified and fine-grained privacy protection mechanism, using cryptography technologies such as attribute encryption, secure multi-party computing,

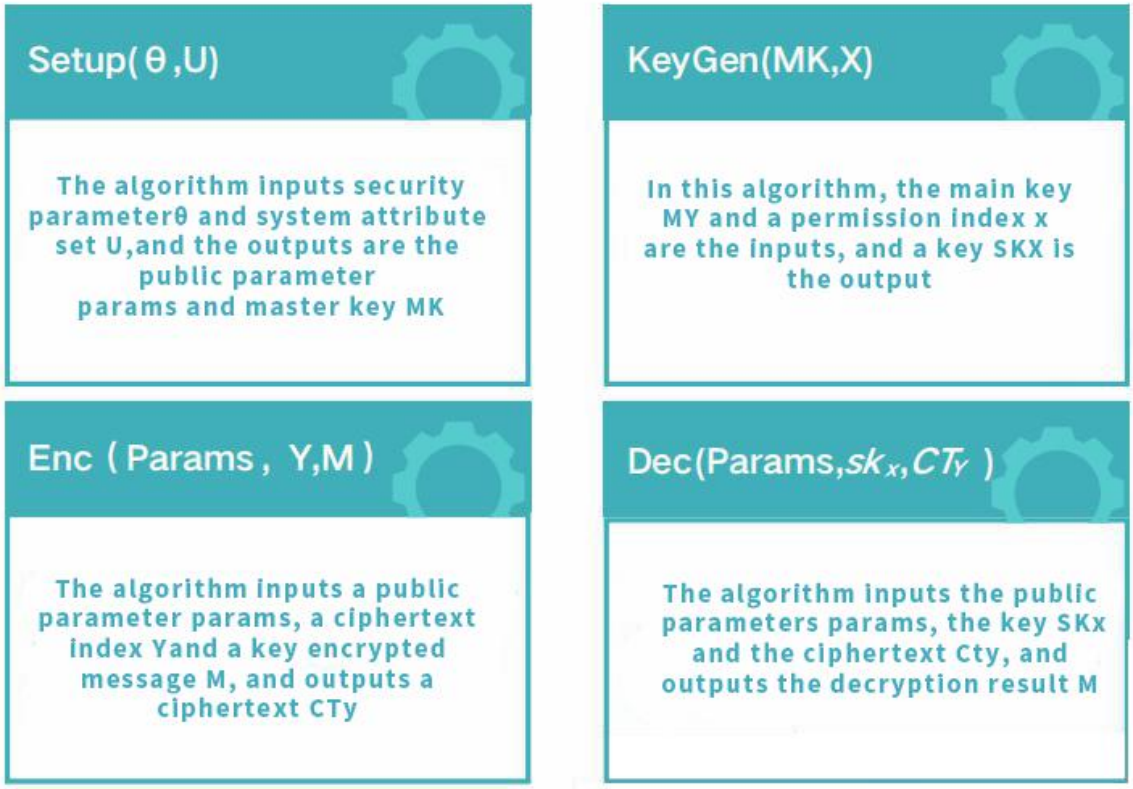
homomorphic encryption, multi-signature,secret key recovery based on secret sharing and secret key reset based on zero knowledge proof, which provides theoretical support and practical means for medical data authentication and trusted security exchange.

Privacy protection mechanism

Medical data often contains various kinds of information, such as a complete diagnosis and treatment file including basic information of patients, diagnosis information, medical advice information, inspection information, medication information, charge information, doctor information, etc. These information have different weights in privacy protection, where personal sensitive information such as patient names, ID numbers, etc, have a significantly higher level of security than routine information such as fee information, medication information, etc. If a high level of protection is applied to all information, it will affect the efficiency of the actual operation and be a waste of resources. The establishment of a hierarchy of medical data privacy protections, with different protections for different levels of information, can effectively improve the efficiency of EZ-Doctor data privacy protection and trusted exchange.

Access control technology is one of the basic means to achieve hierarchical privacy protection. It can set different permissions on different identities and properties of people to restrict their access content, such as financial department personnel can only access relevant charging information but not the diagnosis of doctors. The platform uses an access control strategy based on attribute encryption to achieve fine-grained protection of the classification of private data.

Attribute based encryption [7] represents the user's identity as an attribute set. The encrypted data is associated with the access control structure. Whether a user can decrypt the ciphertext depends on whether the attribute set associated with the ciphertext matches the access control structure corresponding to the user's identity. In the access control based on attribute encryption, users can obtain access rights as long as they have specific attributes, which is not affected by the physical environment factors. Moreover, they can realize multi-value allocation of attributes and solve the problems of fine-grained access control and large scale dynamic expansion of users in EZ-Doctor platform. An attribute based encryption scheme includes the following four basic algorithms:



Secure multi-party computation

In 1982, Andrew C Yao [12] proposed the "millionaire problem" as an example of secure two party computing. In 1987, Goldreichetal [14] extended the concept of secure two-party computing to secure multiparty computation. The main idea is: in a distributed network, two or more parties execute an algorithm according to their secret input, so that each party can get the correct output while protecting the confidentiality of their input information.

Safe multi-party computation can be abstractly described as a mathematical model required to realize the functional process of the computing process: the m party participates in a cooperative calculation, let f: $\{0, 1\}^* \rightarrow \{0, 1\}^*$ be a mapping of m inputs to m outputs through a random function. xi is the input provided by the participant Pi. After the calculation is completed, Pi gets the i-th item of the output fi (x1, x2,...., xm).

Using secure multi-party computation EZ-Doctor realizes that the data owner retains data exchange and sharing, and ensures that the data cannot be obtained in the process of using data by other demand side. Therefore, secure multi-party computing provides technical solution for the trusted exchange of medical data. At the same time, EZ-Doctor provides a platform and practice for secure multi-party computation algorithms.

Multi-signature mechanism

Digital signature refers to a set of specific symbols or codes attached to an electronic document. It is formed by extracting key information from the electronic document and mixing it with the user's private information through mathematical methods. It is used to identify the identity of the issuer and the issuer's approval of the electronic document, and it can be used by the receiver to verify whether the electronic document has been tampered or forged in the process of transmission. The digital signature can be used to identify the signer and verify the correctness of the signed information. At the same time, it can ensure that the signature information can not be modified by anybody, and the signer can not deny the signature afterwards.

In 1983, Itakura proposed multiple signatures [8]. According to the signature process, there are two forms of multi-signature: sequential multi-signature and broadcast multi-signature. Sequential multi-signature is that the signer signs the message in a certain order; broadcast multi-signature is that the provider broadcasts the message to all signers, and the signer signs the message alone, and then transfers it to the signature collector to form a multi-digital signature. In this platform, according to multiple signers using broadcast multi-signature and sequential multi-signature to realize the trusted and fair-paid exchange of data belonging to multi-party participants. The multi-signature mechanism can effectively solve the data, algorithm and other data assets belonging to multiple parties in EZ-Doctor platform. Multi-signature consists of four algorithms:

Key generation algorithm keygen

Inputs:

Safety parameter K and totaltime period T

outputs:

Initialization share key Skj (i) of member θi, public key PK

Key update algorithm

Inputs:

Current time period j, current share key Skj (i) of member θilpsum

outputs:

New share key in the nextperiod Skj+1 (i)

Sign signature algorithm

Inputs:

In the current time period j,the subgroup participating in multi signature L ⊆ θ , the current share key Skj (i) of each member θi and message M

outputs:

Multisignature of message M by member set L in period j

Validation algorithm

Inputs:

The subgroups participating inmulti signature L⊆θ, message M, signature (j, L, Sig) and public key PK (i)

outputs:

" valid" or "invalid"

Key recovery and reset

After the user's key is lost, there are two methods: one is to recover the key through technical means, the other is to reset the key. If we use the method of key recovery, we can use the idea of secret sharing in cryptography to divide the user's key into multiple sub-shadows, and there are different sub-shadows. When we need to recover the key, we can use enough sub-shadows to calculate the user's key. If we adopt the method of key reset and zero knowledge proof, we can prove that "I am I", that is,"I am the owner of this key", without disclosing sensitive information.

Secrets sharing

Secrets sharing [9] [10] is to split the secret in an appropriate way. After splitting, each share (also known as sub shadow is managed by different managers. A single participant cannot recover the secret information. Only several participants can recover the secret information through cooperation. Using the idea of key sharing, the user key can be divided into several sub-shadows, and the sub-shadows exist in different places. When the key is lost, the user key can be recovered through several sub-shadows. The platform adopts the (t,n) threshold secret sharing scheme, which divides secret K into n share sub-shadows. By using any t (1 < t< n) or more sub shadows, secret K can be recovered. Any t-1 or less sub-shadows can not get any useful information about secret K.

Zero knowledge proof

Zero knowledge proof [13] is an encryption scheme, in which one party (certifier) can make the verifier believe that a certain claim is correct without providing any useful information to the other party (the verifier). For example, when logging into a website, the hash value of the user's password is stored on the web server. In order to verify that the user knows the password, only the hash value of the password entered by the user needs to be compared with the saved result, but the server can know the user's original password when calculating. Once the server is attacked, the user's password will be disclosed. If zero knowledge proof is used, the user login verification can be performed without knowing the user password. Even if the server is attacked, the user account is still safe because the user's plain text password is not stored.

There are two kinds of zero knowledge proof: interactive and non-interactive. Interactive zero knowledge proof requires the verifier to constantly ask a series of questions about the "knowledge" that the verifier has mastered. If all the questions can be answered correctly, the verifier may know its claimed "knowledge" in terms of probability. The non-interactive zero knowledge proof does not need any interaction, and the certifier can publish the protocol, thus proving the validity of the protocol to anyone who takes the time to verify it.

Generalized data exchange

In a narrow sense, data exchange refers to the trusted exchange and sharing of medical data; in a broad sense, data exchange refers to data and knowledge trusted exchange and sharing of data assets (algorithms) and computing power. Data exchange is the core function of EZ-Doctor. EZ-Doctor abandons the data acquisition channel mainly based on copy and paste, takes the blockchain consensus as the basis, makes use of its characteristics of trustworthiness, security and non-tamperability, and transfer data from centralized storage to the chain, achieve a hierarchical and trustworthy exchange of data, let the data really flow.

Specialized data exchange

In order to realize the free flow of medical data, EZ-Doctor provides two technical means: data exchange based on data fusion and data exchange based on algorithm decomposition. The former is suitable for the application scenarios with small data volume and high algorithm complexity, while the latter is suitable for the application scenarios with large data. For different application scenarios, users can select corresponding data exchange means according to specific needs.

- The ownership of data belongs to the owner of data, who owns the data and data is its core asset, and gains profits.
- Data execution is the right of data owners to publish the data to the data exchange platform and to sign the data on the platform. When the data exchange platform has the right to execute the data, it provides a bridge between the user and the owner of the data and provides a secure and trustworthy execution environment for data exchange, and the data exchange platform does not deposit data.
- The data user obtains the right to use the data through the data exchange platform. The data user purchases the right to use the data, algorithm, and computing power on the data exchange platform, and obtains the right to use the data, algorithm and computing power by signing a smart contract with all parties. The data is analyzed and processed in the safe calculation sandbox by using the algorithm and computing power, and valuable calculation results are obtained. After the data calculation is completed, the safe sandbox is automatically destroyed, and the data user gets the calculation result of the data.

• Data rights

EZ-Doctor utilizes blockchain, smart contract non-tamperable properties, and combines with under chain arithmetics, data encryption, security sandbox, and atomic algorithm decomposition technology to realize the separation of ownership, execution, and use of data, so that the rights and interests of all parties owners parties owner, executors, and users of data are fixed. It maximizes the protection of the interests of all parties and data security.

Diagram of data rights

• Data exchange based on data fusion

Different medical data have different weights in privacy protection. According to the sensitive process of medical data information and security requirements, medical data are classified, and different technical means such as cryptography are used to realize data exchange for different levels of medical data. At the same time, the data exchanged is available but not visible to the data users during the exchange process. For this reason, EZ-Doctor has designed the stepped invisible data exchange technology, and according to the sensitive process of medical data information to the security needs, the data security level is divided into the following three categories:

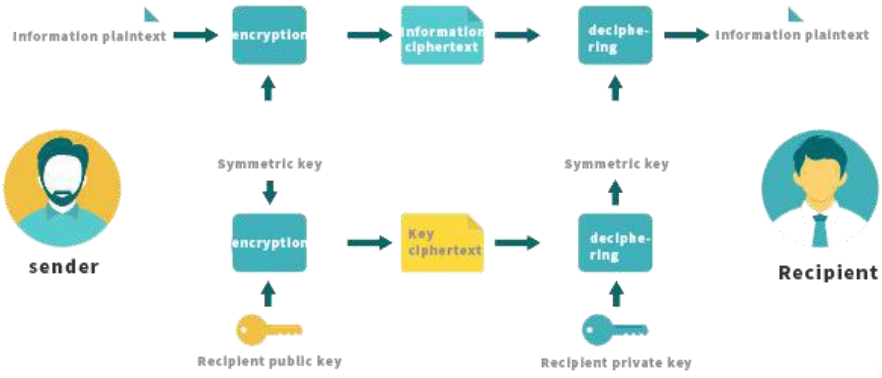
The first level: also known as low-level security data, refers to the loss of data, which will only cause minor damage to the legitimate rights and interests of citizens and other organizations, and will not damage national security, social order and public interest. Generally, this kind of data has low sensitivity, and does not contain or only contain a small amount of personal information, such as the desensitized identity data.

The second level: also known as intermediate security data, refers to the loss of data, which will cause great damage to the legitimate rights and interest of citizens and other organizations, but not to national security, social order and public interest. Generally, this kind of data is related to personal information and has high sensitivity, such as complete medical records of individuals in hospitals.

The third level: also known as high level security data, refers to the loss of data, which will greatly damage the legitimate rights and interests of citizens and other organizations, and may also damage national security, social order and public interests. Generally, this kind of data is sensitive and involves a large amount of personal information of groups or organizations, such as data of medical insurance system.

• The first level data trusted exchange

Digital envelope is a technology that comprehensively uses the advantages of symmetric encryption technology and asymmetric encryption technology for information security transmission. It mainly solves the security problem of symmetric key issue and the problem of slow encryption speed of asymmetric algorithm. It not only plays the advantages of fast and good security of symmetric encryption algorithm, but also plays the advantages of convenient key management of asymmetric encryption algorithm.



Digital envelope encryption technology

The digital envelope is as follows:：

- The sender generates a random symmetric key, encrypts it with the receiver's public key, and generates a key ciphertext.
- using random symmetric key to encrypt information plaintext and generate information ciphertext. Send the key ciphertext and information ciphertext to the receiver at the same time.
- the receiver decrypts the key ciphertext with its own private key to obtain the random symmetric key.
- the receiver uses the random symmetric key to decrypt the information ciphertext and get the information plaintext.

- **The second level trusted data exchange**

In the case of low security level requirements, SSL encryption mechanism is widely used at present. SSL protocol runs above the TCP/IP layer and below the application layer. It uses encryption algorithms such as RC4, MD5 and RSA to provide encrypted data channels between applications.

SSL encrypted data channel mainly solves the following problems: all information will be encrypted, and the third party cannot eavesdrop; it has a verification mechanism to prevent tampering; it is equipped with identity certificate to prevent identity from being impersonated.

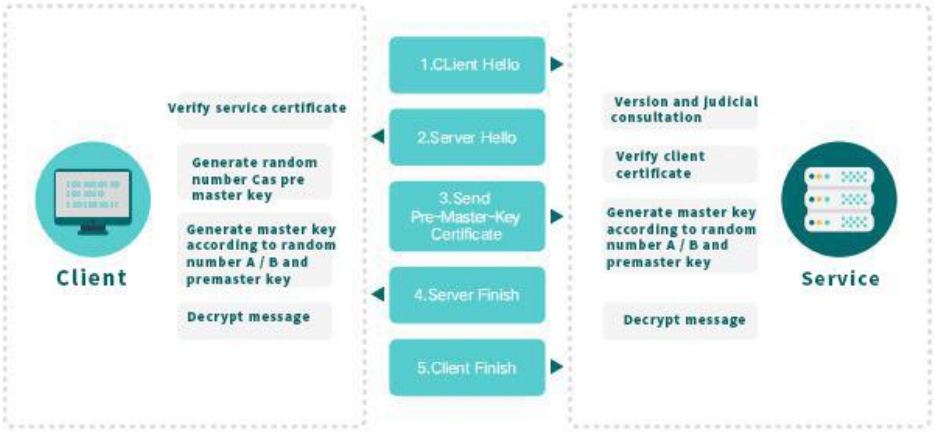


Diagram of SSL encryption mechanism

The main interaction process of SSL protocol is as follows:

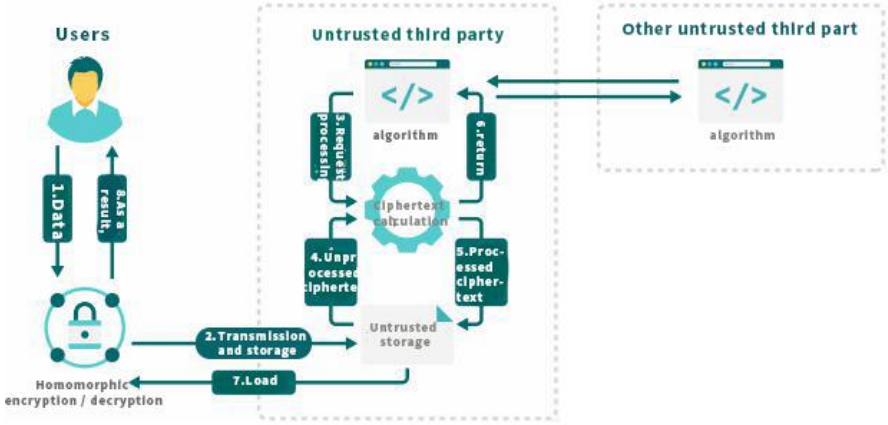
- Negotiate SSL version and encryption algorithm. The client sends the list of supported SSL versions and encryption algorithm, and the server confirms and replies.
- Two way identity authentication. The client verifies the server certificate, and the server also verifies the client certificate, mainly verifies the digital signature, CA authorization,and certificate validity.
- Generate master key based on random number. The client first generates the random number C as the pre-master key, the server generates the master key according to the random number A / B and pre-master key, and the client generates the master key according to the same random number and algorithm.
- Use master key to encrypt messages, and the client and server send finish messages to each other. SSL channel is established, and data packets are encrypted and transmitted using master key.

- **The third level data trusted exchange**

Although SSL secret channel and digital envelope technology solve the security problem of point to point information transmission, there is still the possibility of information leakage. In the remote diagnosis and treatment scenario, patients need to send their own physical examination data and expose it to doctors, then doctors can make corresponding diagnosis and treatment.

The key techniques for secure multi-party computing involve homomorphic encryption, zero knowledge proof, oblivious transmission, and more.

The homomorphic encryption mechanism realizes the calculation of encrypted data in the non-decrypted state and the decryption of the homomorphically encrypted data, and the result is the same as the output result obtained by processing the unencrypted original data by the same method. Secure multi-party computation is applied to collaborative computing in distributed scenarios, where multiple parties can secretly enter data, execute an algorithm, and finally output the correct calculation result. Throughout the process, the respective input data is not visible to third parties and only the final execution results are exposed, thus maximizing the protection of the user's private data.

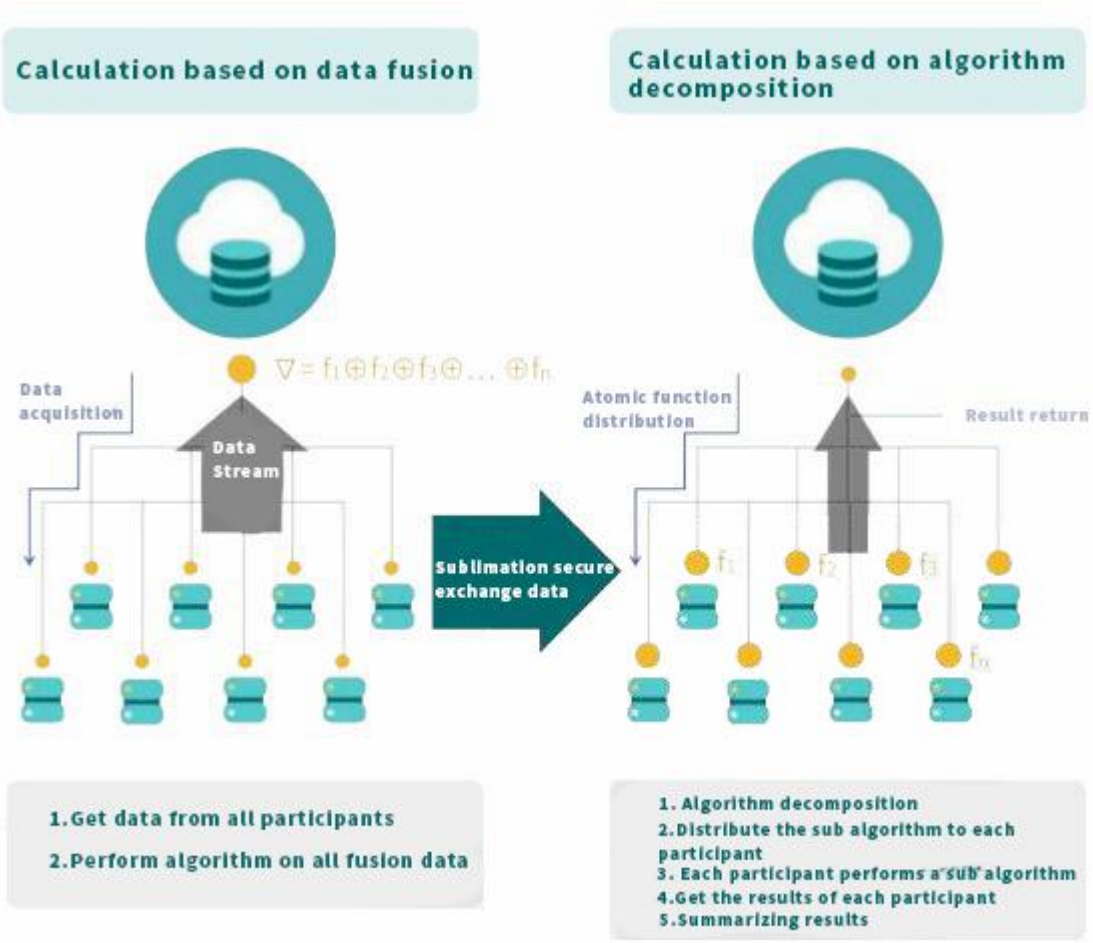


Three-level trusted data exchange flow chart

- **Data exchange based on algorithm decomposition**

Data exchange based on data fusion is to transfer the multi-party data to the data executor safely by multiple data owners. The data executor uses the multi-party data as input to the algorithm provided by the data user, and returns the operation results to the data user. Considering that most medical data are multi-source heterogeneous data with large data capacity, for example, image data is an important part of medical data, in terms of quantity more than 90% of medical data are image data, and the equipment generating data includes CT,X-ray, MRI, PET and other medical image data. According to statistics, the annual growth rate of medical image data is 63%. In this case, the network transmission speed will greatly limit the performance of data exchange. Therefore, EZ-Doctor's data exchange technology based on algorithm decomposition is designed. Even in the case of large data capacity, because the transmission is not the data itself, but the sub-algorithm and its calculation results, the problem of low data exchange performance caused by network transmission speed can be avoided.

The data exchange technology based on algorithm decomposition is to divide the algorithm of Δ into n ($n \geqslant 1$) sub-algorithms f_1, f _2,..., f_ n, so that f _1,⊗f _ 2⊗. .... f_n where f _ I ($1 \leqslant I \leqslant n$) is the atomic algorithm That is, it can no longer be decomposed into any sub-algorithm; then the data user sends the sub-algorithm to the data owner respectively, where the sub-algorithm and the data owner are not one to one correspondence, which may be a many to one relationship; Finally, the data owner takes his own data as the input of the sub-algorithm, and sends the calculation results to the data user safely. After the data user collects the calculation results of all the sub-algorithms, he can get the expected operation results of the algorithm through the operation.



Comparison of two narrow data exchange methods

In order to improve the data processing ability of data exchange terminal based on algorithm decomposition. EZ-Doctor focuses on the in-depth learning and reasoning AI chip for edge applications, It provides the best programming flexibility for performance optimization and data reuse of medical image computing.

With the increasing demand of Artificial Intelligence Computing, the general purpose computing scheme begins to show its own bottleneck. In the current "CPU + GPU" computing scheme, which occupies the absolute advantage of the artificial intelligence training chip market, although the universality of neural network support is good, there is a lot of room for improving the operation efficiency and energy consumption of this heterogeneous computing.

One of the core of artificial intelligence is deep learning algorithm, and image recognition is one of the fastest growing areas of AI technology. Deep learning algorithms such as convolutional neural network (CNN) and deep neural network (DNN) use the amount of data and computation as the driving force of the model, and reduce the number of parameters needed to be trained by the neural network through the sharing of field and weights, and finally achieve the image recognition performance beyond the traditional methods. At present, almost all the mainstream chip manufacturers in the industry, such as NVIDIA, Movidiusx Intel, Hisilicon, etc., have started to launch deep learning based chips.

Although GPU has many advantages in parallel computing, it is not specially designed for machine learning after all. FPGA requires user independent programming. It is mainly for enterprise users in professional fields, with high complexity. ASIC refers to the integrated circuit designed and manufactured according to the requirements of specific users and the needs of specific electronic systems.

The characteristics of ASIC are to meet the needs of specific users. Compared with general integrated circuits, ASIC has the advantages of smaller volume, lower power consumption, higher reliability, higher performance, enhanced confidentiality, and lower cost. The "AI + medical" chip developed by EZ-Doctor can provide a powerful deep learning model compiler and software SDK development package, easily transplant mainstream deep learning frameworks such as Caffe and tensorflow, and run common CNN, DNN and other neural network models.

Computation power fusion and data calculation

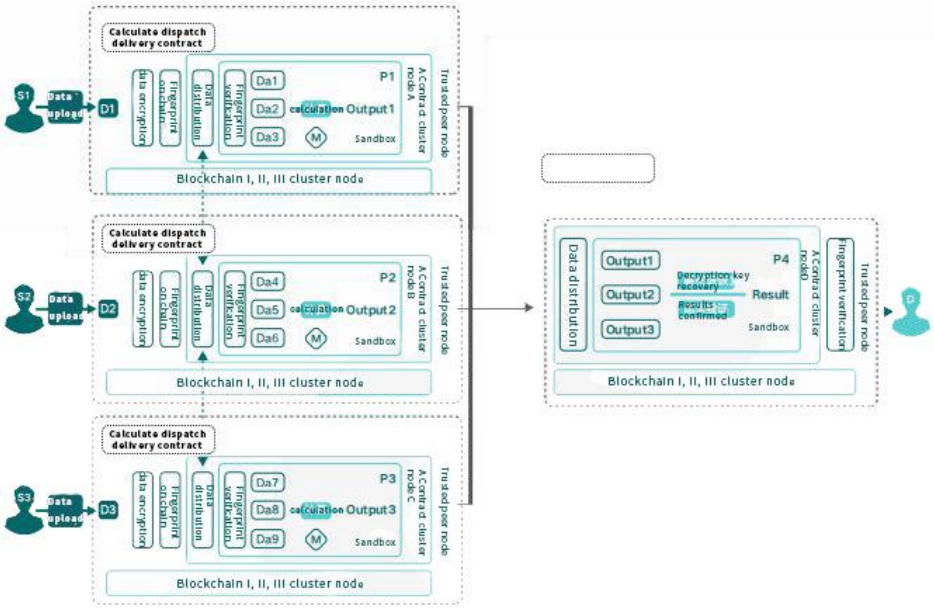
Computation power fusion is the integration of off-chain storage and computing resources on top of the blockchain and smart contracts to form a distributed computing platform based on the blockchain and smart contracts. To meet the full range of user needs for data, the data exchange offers three flexible computing scenarios: local computing, off site computing and fusion computing. Data owners want to use their own data resources to provide some services to the outside world, but lack of data analysis algorithm. In order to solve this problem, the data exchange platform provides data local computing. First, the data owner finds the required algorithm in the data exchange platform, and then signs the data exchange smart contract. After the smart contract is executed, a safe sandbox is generated by the data owner. The data and algorithm enter the sandbox, and the calculation result is returned to the data owner after the calculation.

In order to solve this problem, the data exchange platform provides data remote computing. First, all parties of the algorithm find the required data in the data exchange platform, and then sign the data exchange smart contract. After the smart contract starts to execute, all parties of the algorithm generate a safe sandbox. The data and algorithm enter the sandbox, and return the calculation results to all parties of the algorithm. This method is called data off-site calculation.

For large scale computing, the provision of data and algorithms is not the main problem, and computing resources become the main limitation. In order to solve this problem, data exchange platform provides data algorithm fusion calculation. Thanks to the multi-party collaborative computing platform built by the integration of computing power, data and computing participants sign multi-party smart contracts. After the contract is executed, a safe sandbox is generated in the computing power environment. Data and algorithms enter the sandbox through the digital envelope technology, and the returned results are calculated, and the sandbox is destroyed to ensure the security of data and algorithms.

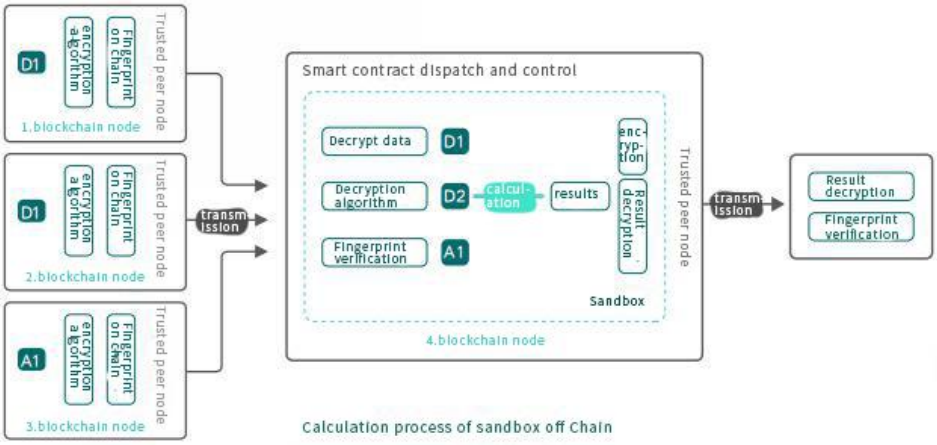
Three computing scenarios are mainly selected according to the actual use, and the influencing factors are: data scale, algorithm dependence complexity, and storage computing power requirements. When the scale of data is large, the cost of transmission will be high. At this time, choosing to calculate on the data side can save a lot of network bandwidth and transmission time. When the algorithm depends on the environment more complex, choose to calculate in the algorithm side, can reduce the preparation time of the computing environment.

Sandbox isolation is the main technology used in data calculation. Sandbox implementation is divided into on chain sandbox and off-chain sandbox. The sandbox on the chain can meet the small-scale computing needs with the help of smart contract virtual machine. The sandbox off the chain is mainly suitable for the calculation of large amount of data. The main feature of sandbox on the chain is that the blockchain has its own execution environment, which has sandbox characteristics and is efficient. The calculation flow of sandbox on the chain is shown in the figure.



Calculation process of sandbox on Chain

Although the sandbox on the chain is easy to use, it is limited by the lack of storage and computing power of the blockchain itself. When there is a higher demand for storage and computing power, the off-chain sandbox needs to be used. The off-chain sandbox runs directly on the operating system, it provides a protected computing environment, makes full use of the computer's efficient storage and computing capabilities, and ensures that data and algorithms are not spied or maliciously attacked. The calculation process of sandbox off the chain is shown in the figure below.



Calculation process of sandbox off Chain

Data trusted exchange platform

Traditional data exchange requires the help of a centralized mechanism to achieve data exchange and calculation. In the process of using, the user's data and operation are completely transparent to the platform, and the user cannot know whether the platform deposits the data or illegally uses the user's data.

With the help of key technologies such as blockchain, smart contract, safe sandbox and secure multi-party computing, the data trusted exchange platform makes data safe transmission, controllable computing process, isolated computing environment and traceable operation, so as to ensure the safety and credibility of data exchange process and data computing process.

At present, the distribution of medical resources in the medical industry is unbalanced. The number of high quality hospitals in different regions varies greatly. Good hospitals are mainly located in the big cities, good doctors and equipment are mainly concentrated in the AAA grade hospitals, and the situation of basic medical institutions is not optimistic. Based on the data exchange platform, a collaborative trusted exchange and computing system is built to link various medical big data sources, including patient medical record database, image database, medical paper database and medical equipment. The visualized smart contract platform is used to provide doctors and experts with the means to formalize the diagnosis process and medical knowledge, and generate the smart contract system serving the functions of smart diagnosis and treatment, hierarchical diagnosis and treatment, disease management and disease prediction, so as to speed up the flow of medical data among hospitals, doctors, patients, medical insurance institutions and governments, and link the whole medical industry entity into an organic ecology which promotes the overall efficiency of the medical industry, so as to solve the uneven distribution of resources to a certain extent by means of technology.

Data exchange platform ecosystem

The data exchange platform system mainly consists of three parts: blockchain platform, smart contract platform and trusted data exchange platform. The blockchain platform is mainly used as the data storage layer to provide data storage services for the smart contract platform.

Smart contract platform is mainly used to ensure data and computing security in untrusted environment. The trusted data exchange platform realizes data exchange and distributed computing based on index form based on smart contract.

Smart Contract

The acquisition and accumulation of medical knowledge takes a long time and its mobility is poor, which limits the sharing and transfer of medical knowledge to a certain extent. In the form of cognitive computing, using computer description language, following the clinical practice evidence the medical smart contract extracts the knowledge of doctors into the automatically executed contract, which provides the basis for the flow and capitalization of medical knowledge-

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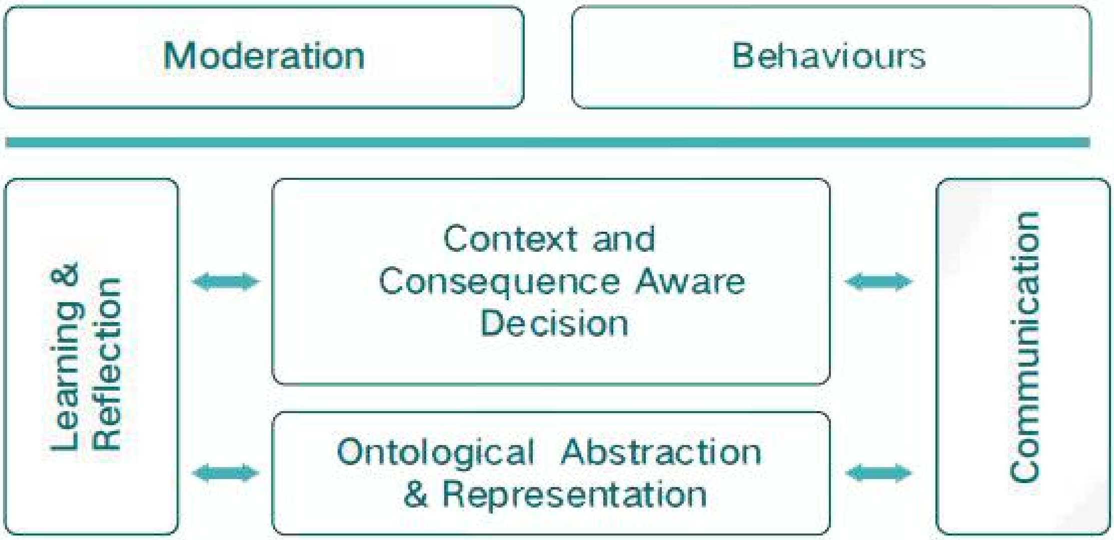
Cognitive computing (CC) is derived from computer systems that simulate the human brain. Artificial intelligence, through human interaction with the natural environment and continuous learning, helps decision makers to unveil extraordinary results from different types of massive data to achieve varying degrees of perception, memory, learning and other cognitive activities. With the advent of the blockchain the advent of the blockchain era, the abundance of data and knowledge has opened up new opportunities for cognitive computing.

EZ-Doctor uses the generalized knowledge model in cognitive computing (as shown in the figure) to define the upper ontology of medical knowledge to support the implementation, communication, reasoning, decision making, planning, learning, reflection, supervision and other high level behaviors of medical knowledge. The purpose of establishing the generalized knowledge model is to establish a unified ontology of knowledge concept, which has:

(1) The flexibility of unified description of multi-field knowledge and data;
(2)Universality of description and reasoning for many tasks;
(3) To quantify and respond to the uncertainties in knowledge and data;
(4)Transparency of cross domain knowledge collaboration and cooperation;
(5)Self-learning and adaptive intelligence in the process of knowledge execution.



Generalized knowledge model

Executable knowledge framework

Executable knowledge framework instantiates the generalized knowledge model as an executable application entity, which consists of five levels.

First, the knowledge description EZ-Doctor defines the formal language and interpreter to describe the generalized knowledge model; the knowledge authoring tool adopts the visual programming mode to support the creation of various knowledge elements, and transforms its description into the knowledge description language. The tool will be used by sub-domain experts (such as doctors) without programming technology to maximize its usability. Secondly, the knowledge library contains the knowledge described by the experts in each sub-domain, and generates their own generalized knowledge description language through knowledge creation tools.

Thirdly, deployment profile describes the physical deployment scheme of each knowledge, such as how to divide or combine knowledge into agents and the physical distribution of each agent. Application customization (application Enactment)automatically generates application entities (such as web application, web sevices) according to deployment planning and knowledge description language, and defines the implementation characteristics of application entities(such as front-end interface). Application pool is used to implement sub domain knowledge and interact with users.

Knowledge calculation language PROforma

Proforma is a development environment of knowledge, cognitive model and description language to support decision making system, which has developed to the second generation [14]. Through the expression of mathematical form, it provides a complete set of operation tools for designing, testing and making medical process to support doctors to edit and use clinical decision support and auxiliary system. The proforma language defines four kinds of executable tasks:

(1)(Action):

That is, in the process of taking care of patients, any external tasks that need to be performed. Such as injection, or CT detection.

(2)(Enquiries):

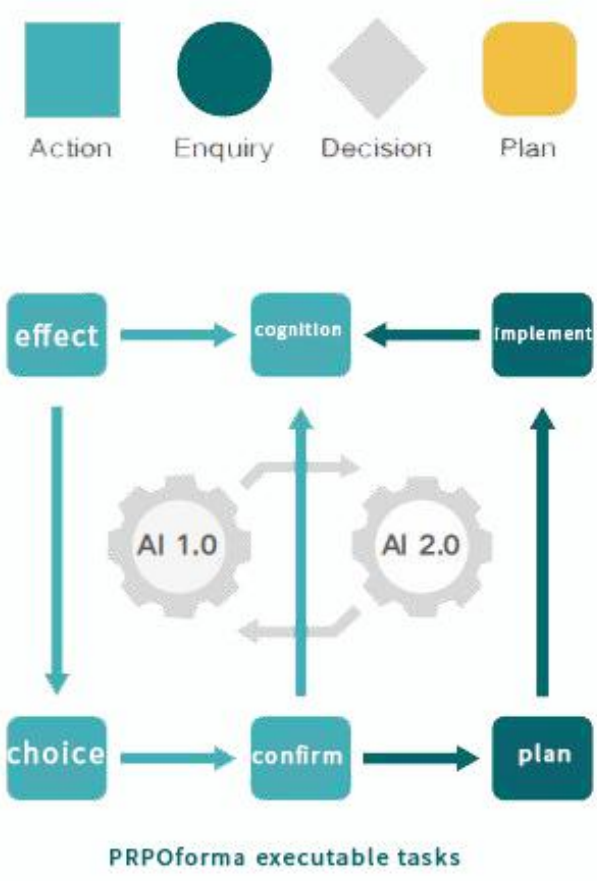
The returned information after execution is mainly in the form of data. It may come from operating equipment or patient medical records.

(3)(Decision):

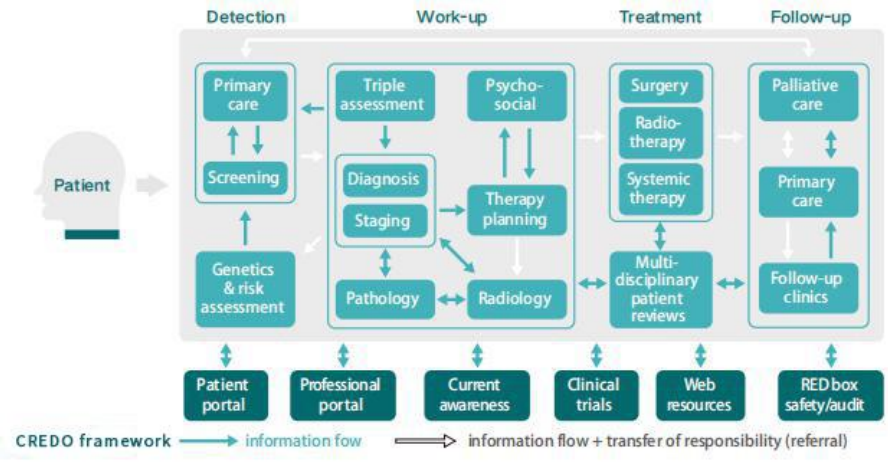
Any form of medical choice, such as diagnosis, treatment, prognosis, risk accessment or referral decision.

(4)(Plan):

A series of time series tasks. Planning uses a common framework for implementing clinical algorithms, protocols, guidelines, care paths, and more.



PRPOforma executable tasks



Based on proforma 2.0, EZ-Doctor is used to support distributed computing of the language, develop decision support system and new DApp application with learning, autonomous cognition, knowledge collaboration and evolutionary capabilities.

Smart contract

The medical smart contract is develo-ped by using proforma language, and its design fully follows the clinical practice evidence, extracts the knowledge of doctors into the automatically executed contract, and provides medical decision support. Smart contract enables doctors' knowledge to be calculated and provides the foundation for medical knowledge to be capitalized.

According to the service object, it can be divided into individual patient-oriented and group oriented smart contracts. The functions of smart contracts for individual patients include data acquisition and interpretation, risk assessment and recommendation, monitoring, recommendation and decision making, care planning and care, work flow management, etc. The functions of smart contracts for groups include: quality and safety audit, adverse outcome event monitoring under large scale medical services, cost control, resource optimization, analysis and in-depth study.

The CREDO framework is a typical example of smart contract providing medical decision making. CREDO expresses knowledge as task network on the basis of task ontology. Based on Domino decision making cognitive model, CREDO adopts decision making ontology framework based on logical argumentation, which has become a widely used theoretical framework and implementation tool in the field of medical decision making. CREDO has a strong modeling ability for the diagnosis and treatment of many diseases.

For example, the CREDO trial uses smart contracts in clinical research to focus on the treatment process of breast cancer patients. The system provides decision support, nursing planning and multi-disciplinary treatment services in the whole "medical journey", and realizes the computerization and automation of "medical journey". CREDO is designed to support cross department seamless patient management, from basic care to secondary care, from diagnosis, treatment to follow up. It covers the whole process of breast cancer patients' medical treatment, including 220 medical services and multiple decision points. The purpose of the trial is to reduce the errors in the medical process as much as possible through decision support, so as to achieve zero error medical treatment for patients.

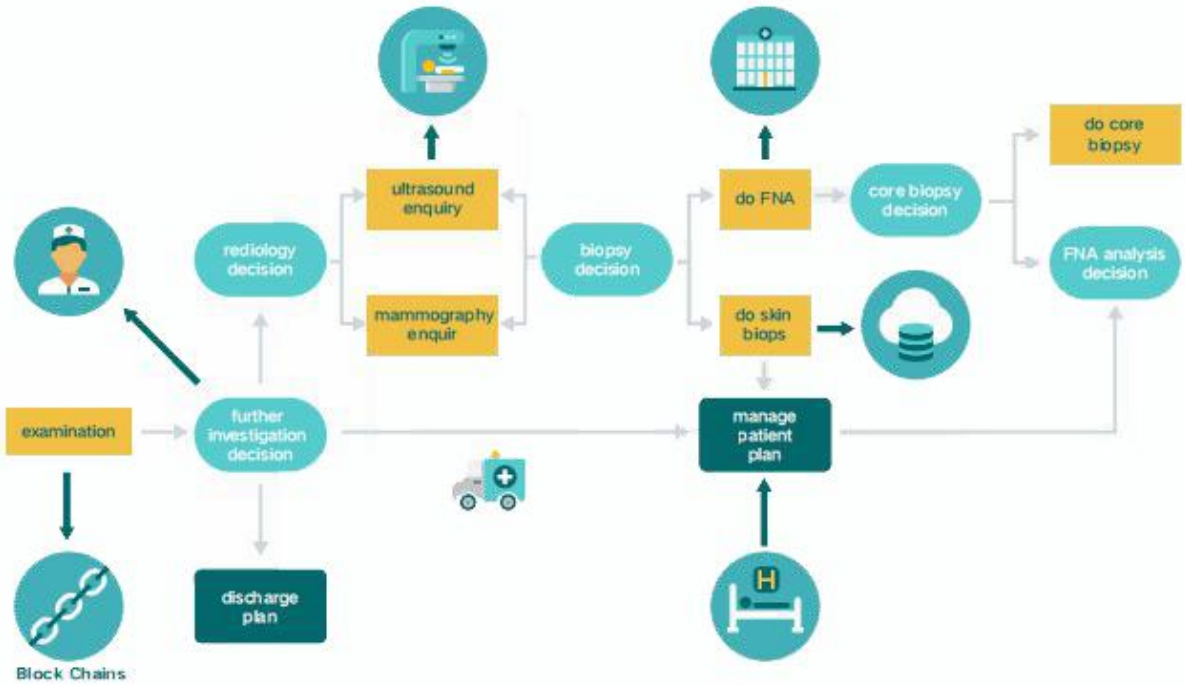
Other widely used medical smart contracts include CAPSULA, LISA, and etc. CAPSULA [16] is used to assist UK general practitioners in prescribing common diseases. Writing a prescription is the first step in medical assistant decision making. CAPSULA generates a list of related drugs and corresponding clinical evidence by obtaining patient data to assist prescription. The system has been tested in 42 general practitioners' sites in the UK, and the results show that compared with the expert group, the decision making of general practitioners in the system has increased by 70%; the prescription of cheaper but equally effective drugs has increased by 50%, while the speed of decision making has increased by 15%.

EZ-Doctor uses the formal smart contract based on cognitive computing to fully solve the problem of collaborative computing of medical sensitive data and integration of heterogeneous resources, and realize the formalization of knowledge and decision-making cognition.

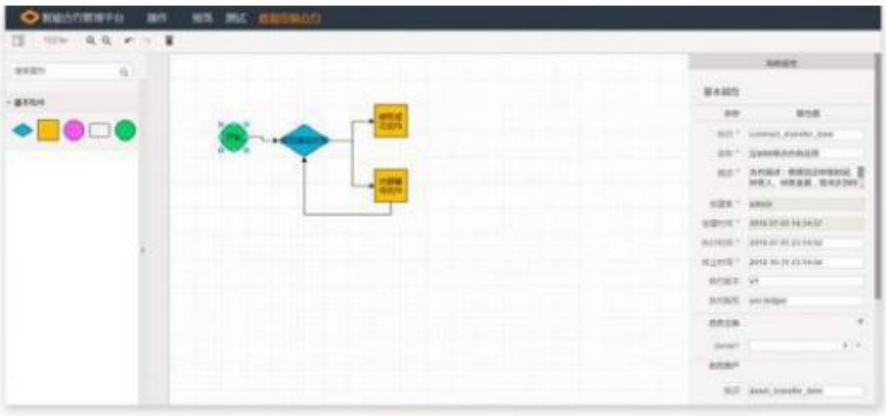
Knowledge Circulation

The platform adopts a new smart contract architecture with a formal verification system as the core, supports cross chain access, supports visual smart contract development, supports up chain verification and effect tracking on contracts, supports massive services, and has industrial grade application standards; while the platform serves the medical industry, it also provides developers with a developer ecology similar to AppStore, from which application developers can also benefit module developers for application development services.

EZ-Doctor integrates and standardizes "knowledge, resources and effects" into a digital asset that can be priced, and provides the trading and settlement capabilities of digital assets. Through market-oriented behavior screening, it can achieve the best results with the best medical knowledge and experience, greatly improve the utilization efficiency of data and knowledge, make the knowledge flow, and fully realize the value of doctors. The distribution of medical and health knowledge is shown in the figure below.



Flow of medical smart contracts



Visual design environment of smart contract

Development Environment

The EZ-Doctor platform provides a semantic-based visual development environment to realize the formal verification of smart contracts.

▪Visual development environment

The visual development environment of the contract mainly includes the following four aspects.

(1) Visual design of smart contract

The contract design process is realized by contract execution diagram, The smallest construction in the contract execution diagram is: query,action, decision making and plan are dragged in the user interface with friendly interaction, which changes the design of smart contract from hard coding to visual drawing, so that the person who writes the contract does not need to understand the programming, so that the user can concentrate on solving the business thinking and focus on building the logic between tasks. It simplifies the preparation requirements of the contract, improves the secondary development ability, and increases the versatility of the contract.

(2) Visual management of smart contract:

Smart contract products, smart contract templates and execution contracts are used to manage smart contracts in a three-tier structure. Smart contracts are queried, edited, reviewed, released,tracked and other operations in a visual way, so that smart contracts can be used in general scenarios and can be integrated with application scenarios quickly.

(3) Contract template design to improve application and expansion

Using the idea of template to design and manage smart contracts makes smart contracts have strong adaptability and high scalability.

(4) Visual monitoring of smart contract

It can monitor the smart contract in multiple aspects, including the physical environment of smart contract execution, smart contract execution service, key steps of smart contract, visual tracking of smart contract audit, visual tracking of smart contract execution, etc. In computability theory, if a series of data operation rules can be used to simulate a single tape Turing machine, then it is Turing complete. Here data operation rules can be a programming language or a specific instruction set implemented in a computer. The EZ-Doctor in the visual development environment is Turing complete. It can develop a variety of functional modules according to the actual smart medical application requirements, so as to improve the platform intelligence.

Formal verification

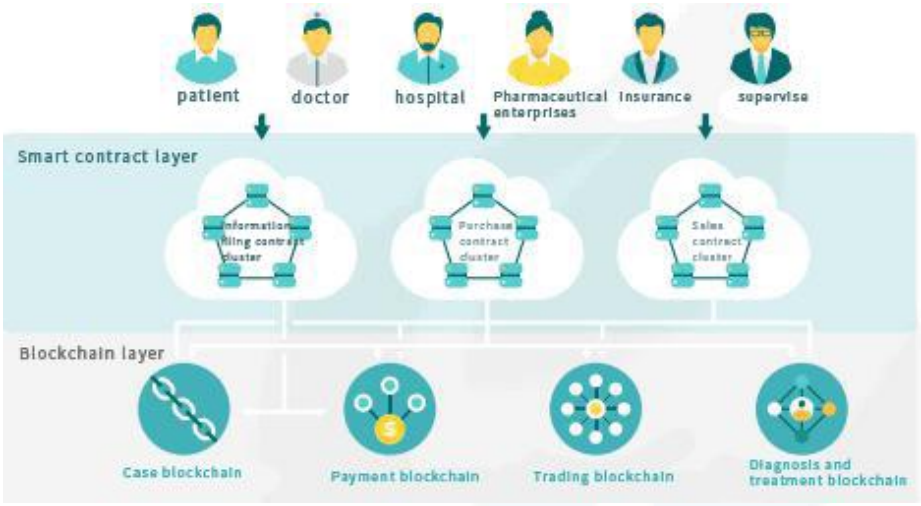
Formal verification is based on the mathematical modeling method to describe the system. Through formal verification,developers can review the security of the program in advance, eliminate the logic vulnerabilities and security vulnerabilities,so as to ensure the security of the contract.

Medical smart contract is the formalization and calculation of doctors' knowledge,and its decision making and judgment results are directly related to the health status of patients. Through the smart contract virtual machine to complete the scheduling and operation of the contract, how to ensure the correctness of the contract logic, whether the execution process is credible, whether it is vulnerable to external interference and destruction, whether the operation process of the contract is stable, that is, whether the same input always produces stable output results, we introduce formal verification technology to ensure the credibility of the contract execution process and results.

Formal method is to describe and reason computer based system with mathematical method. Intuitively speaking, it is specification language + formal reasoning, which is supported by precise mathematical means and powerful analysis tools in technology. Its expression forms usually include logic, discrete mathematics, state machine, etc. Specification language includes grammar, semantics and satisfaction relation. This platform introduces formal method, which is applied to the whole life cycle of smart contract generation and execution. Formal verification method can check many attributes of smart contract, such as fairness, reachability, boundedness, livelock, deadlock, unreachable and stateless ambiguity.

Cross chain smart contract

At present, the design idea of various blockchain networks is to let the whole industry run on a chain. Because each chain is independent and closed, there are great difficulties in its interaction. Even the same network is difficult to achieve cross chain interaction. For example, the private chain (or Consortium chain) built by the enterprise using Ethereum is difficult to connect and interact with the public chain. At the same time, the function and performance of these blockchain systems can not fully meet the industrial application scenarios.



In the specific application, it is inevitable to encounter the transfer of resources from one resource system to another in the process of data exchange, and the construction of the two resource systems is different from time to time. In this regard, we take the multi-chain and multi-contract as the design criteria, make full use of the tree structure of the heterogeneous forest network, divide the leaf nodes, branches and backbones according to the business logic, and make each subset fully customized, which not only ensures the efficient operation of the business subset in a stable and reliable environment, but also ensures the information interaction ability with the overall system. In addition, EZ-Doctor provides a decoupled cross chain channel protocol, empowerment it to access and interact with resources outside the system. It also supports data exchange between different business chains. Through the cross chain smart contract, let the business return to the business itself, restore and support the real application scenarios.

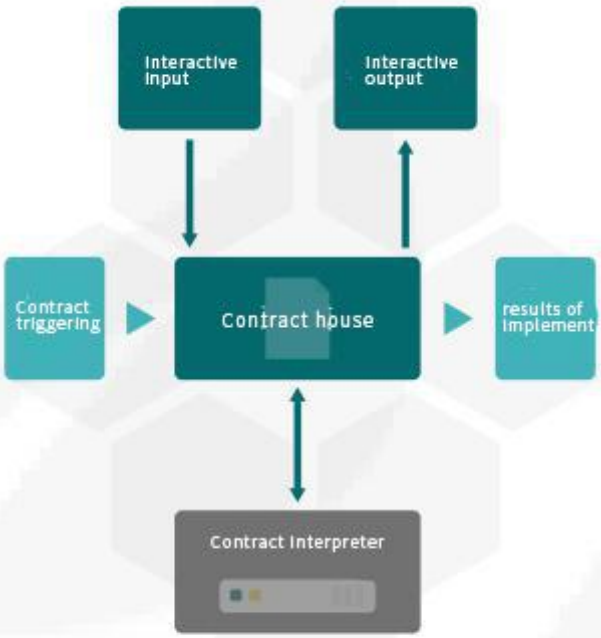
Interactive smart contract

The traditional smart contract is only designed for account fund transfer, and its function is very limited, so it can't meet the diverse needs after knowledge calculation. Therefore, we redesigned the smart contract and it adopts the execution mode of the middle layer, which not only makes the smart contract compatible with more design languages, but also makes the smart contract have interactive ability.

Compared with the traditional smart contract, the interactive smart contract provides a broader application space, breaks the limitation that the smart contract can only be used in specific data, and through interactive means, the calculated knowledge can get a good expression, more in line with the needs of the industry.

Operation of interactive smart contract

In the medical field, we can get a better experience than the traditional medical guide by calling the smart contract designed for a specific disease. At the same time, a good interaction design can fit the consultation, screening, diagnosis, treatment and rehabilitation process of the diagnosis and treatment process, so as to provide better assistance for doctors.



Interactive smart contract architecture

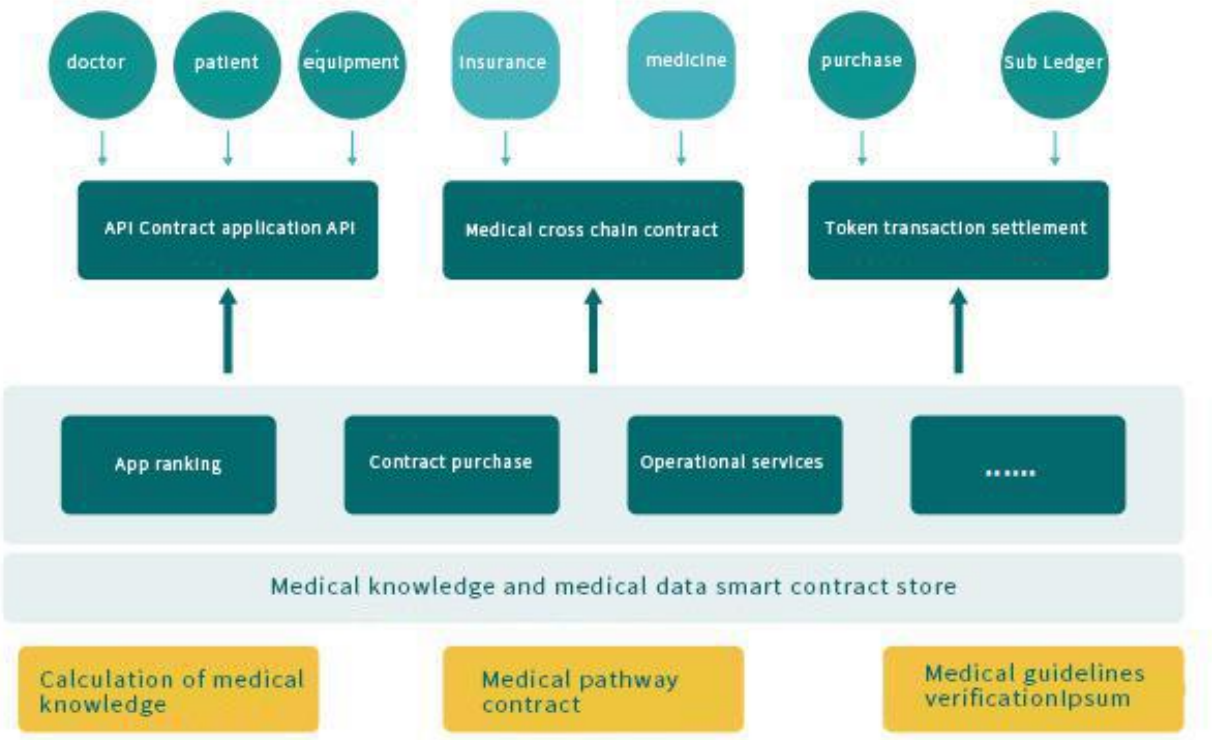


Diagram of smart contract store

Smart contract store

Smart contract store is a medical knowledge sharing platform for medical institutions, doctors, smart devices and other medical diagnosis decision makers. It is a C2C medical knowledge computing smart contract trading platform with a complete multi-mode external service interface (Baas service + API service +APP service).

Based on the evidence of medicine and clinical experience, top medical experts formalize the medical knowledge into smart contract and share it in the open smart contract store in a component-based way. Medical workers obtain accurate, credible and timely updated medical knowledge through the application service credit, and apply it to diagnosis and treatment equipment through standard version application program interface to make the best diagnosis, optimize treatment scheme, or load it into smart auxiliary medical equipment, so as to improve the rehabilitation efficiency and intervention effect of smart equipment.

The blockchain based smart contract store adopts a distributed system architecture and combines with the medical mode application scenario for data fragmentation, which achieves automatic expansion, high availability and security against tampering in the open self-management mode of the smart contract store. Furthermore, the smart contracts store supports natural language fuzzy search, builds multi-modal data models of medical knowledge, integrates data elements that express basic attributes, semantic attributes, underlying features and raw data, and visually maps the overall medical knowledge smart contract family.

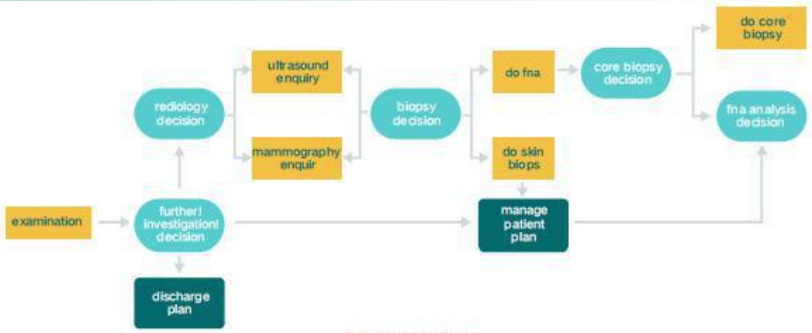
Business application

With the help of blockchain and smart contract technology, EZ-Doctor realizes decentralized medical data sharing and knowledge calculation, supports smart diagnosis and treatment, hierarchical diagnosis and treatment, telemedicine, chronic disease monitoring and health management, large-scale medical research collaboration and other business applications, so as to realize deep sharing and flow of medical knowledge between regions with huge difference in medical level, and achieve the homogenization of medical level . At the same time, EZ-Doctor has built a surgical big data quality cloud control system and a large-scale queue research system to improve medical research and quality control work, and use the power of data to promote scientific and technological progress.

Smart diagnosis and treatment

EZ-Doctor uses blockchain technology to build an underlying platform for trusted medical data sharing, regulates the medical information circulation mechanism, strengthens the electronicization of medical cases, and ensures the integrity, authenticity, privacy, and intelligence of medical information. In the process of diagnosis and treatment, doctors can stitch together data from different institutions with scattered control rights to provide a reliable and complete diagnosis and treatment record of the patient's entire life cycle. At the same time, doctors' mature clinical knowledge and experience flow through the platform in the form of smart contracts to automate and efficiently complete medical decision support, so that the smart treatment truly has legal business compliance and medical quality control, which is perfectly integrated with modern precision medicine based on big data, artificial intelligence and genetic testing.

EZ-Doctor also builds a hierarchical system of interconnected diagnosis and treatment and tele-medicine, so that each medical institution network node that joins the EZ-Doctor ecosystem can share medical information in a fair, safe and trusting manner, while ensuring that medical information does not flow out of the authorized boundary of the data owner. It will significantly promote the safe, convenient and controlled flow of medical information in graded diagnosis and treatment. With the expansion of the ecological network, medical institutions can quickly obtain historical medical information on the admission of patients under authorized conditions, and transfer the information from the first consultation to specialized higher level medical institutions to quickly formulate medical plans and rationalize the allocation of medical resources, thus achieving a comprehensive and efficient hierarchical diagnosis and treatment scientific medical system.



智能诊疗流程

The traceability of blockchain can help medical institutions track the recovery of patients after smart diagnosis and treatment, and provide the basis for efficacy evaluation; at the same time, the non-tamperable ability of blockchain can ensure the standardization of medical equipment to perform smart diagnosis and treatment. After the application of smart contract, smart diagnosis and treatment can realize the active supervision of medical treatment. When emergency situations, abnormal events and violations occur in the process of medical treatment, smart contract will send a notice to the management in real time, so as to better improve the quality of medical treatment and ensure the safety of patients.

Chronic disease monitoring and health management

With the aging of the population and the increase of the elderly population in the world, the challenges brought by chronic diseases will continue to increase. The World Health Organization(WHO) suggests that chronic diseases have become the most important cause of death in the world. It is estimated that by 2030, the number of people dying from heart attack and stroke in developing countries will exceed that of epidemic diseases.

There are many risk factors involved in chronic diseases, and the detection of them involves the fusion and exchange of many smart wearable devices and daily monitoring data. With EZ-Doctor's blockchain technology, it is possible to observe the various risk factors associated with chronic diseases from a holistic perspective, bringing together a variety of chronic monitoring data that can be shared in mutual trust. Establish a data exchange platform and chronic disease risk warning model based on complete medical data, realize intelligent monitoring/detection equipment data trusted exchange and clearing and settlement function, realize real time monitoring and warning of key chronic diseases.

In case of high-risk early warning, the monitoring system will provide corresponding auxiliary diagnosis, smart rehabilitation equipment and health management scheme according to the early warning level and chronic disease characteristics based on artificial intelligence algorithm and smart contract technology platform, so as to cope with chronic disease and improve health status.

Large scale medical research collaboration and ethical review

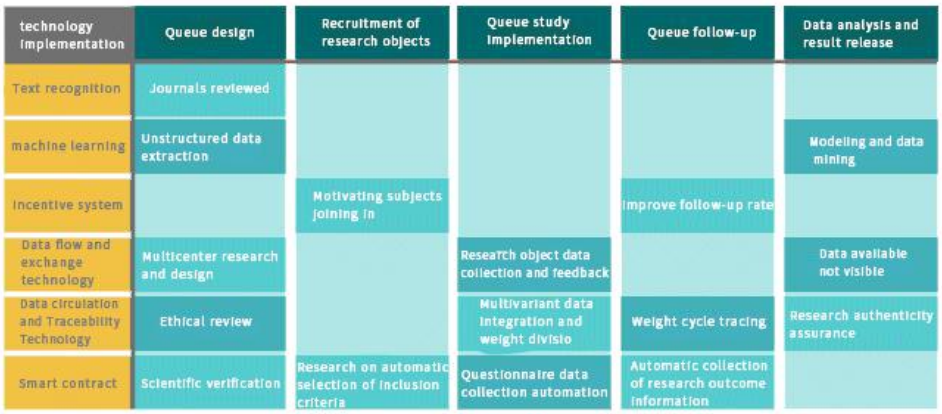
Large scale medical research collaboration, represented by multi-center cohort study, is the strongest research on the evidence chain of disease causality. Almost every issue of the top medical journals reports results from large cohort studies. However, due to its high requirements, more research objects, complex data collection, long tracking time, the cost is very high. The average cost of a typical large cohort study is about $30 million.

The EZ-Doctor platform based on blockchain technology is the best tool for large scale medical research collaboration. It supports the launch and completion of research on a global scale, and significantly shortens the time of cohort research from the recruitment, screening, questionnaire design, data collection, clinical trials to outcome follow up. In the traditional large-scale cohort study, especially in the multi-center study, it takes about 1-3 years to recruit research subjects and 5-20 years to complete the follow up of the outcome.

However, EZ-Doctor, through the incentive system and encryption technology, promotes the large research center to provide data exchange, and even encourages individuals to respond to recruitment, reducing the recruitment time to several months. At the same time, blockchain technology realizes the integration of multiple types of data(including genes, behavioral factors, environmental exposure factors, occupational habits, medical records, etc.), completes the tracking and even traceability of the whole life cycle of the research object, and reduces the follow up time and cost of the outcome by 5-10 times. The blockchain data can't be tampered, which makes the whole research system self-evident, so as to reduce the falsification and errors in the records of large-scale queue database of the research.

Ethical review is the foundation of all medical research. Before launching large-scale medical research, the research program needs to be reviewed by EZ-Doctor medical ethical review agency. Evaluate the possible risks, scientific nature and benefits completely to ensure that they conform to the basic principles of respect, benefits and fairness. At the same time, after the collaboration of the large-scale modern medicine research, the consent authorization and the permission to share data of the participants are recorded by using the blockchain technology, and the submitted smart contract algorithm is reviewed, which protects the legitimate rights and interests of the participants from the source and makes the research meet the ethical requirements.

In the long run, the medical data exchange system built on the EZ-Doctor platform can help to obtain more real, comprehensive and credible research data, and can establish a methodological system that is closer to the real clinical conditions and supports real world clinical research. Even based on the completeness of the system, it is possible to conduct a series of new "large-scale medical studies" that were previously thought of but could not be carried out due to the lack of reliable data, answering questions that cannot be answered by traditional clinical trials, such as the actual effects of drug treatment and population differences, the comparative effects of different drugs, etc. Promote a "heterogeneous" collection of research methods.



Technical support of EZ doctor platform for queue research

Surgical quality control and tandardization

Surgery is an indispensable part of modern medical treatment. According to statistics from the World Health Organization, nearly 50% of inpatients' adverse events are related to surgery. The surgical quality control system based on EZ-Doctor ensures the integrity of surgical records and patient information through blockchain technology, and records the patient's authorization of data to achieve extensive data sharing.

At the same time, EZ doctor's smart contract and surgical data mining technology are combined, relying on clinical path and surgical experience, and based on a large number of real data, more than 400 smart preoperative risk assessment models and surgical options are provided to patients with optimal surgical solutions.

The traceability of blockchain helps medical institutions track the patients after surgery, provides basis for efficacy evaluation and quality control,and supervises the management of hospitals. Surgeons can also adjust the structure of the smart contract through the post-operative situation. The lower the post-operative mortality and recurrence rate, the more the smart contract will be called and shared, so as to realize the knowledge sharing, exchange and promotion of surgical experience, and further control the surgical risk.

Data driven health insurance

The traditional health insurance only covers the healthy people. The middle and high risk people who really need health insurance either have no place to buy insurance or can only avoid the risk control system to buy insurance with illness. It is difficult to realize the original intention of risk sharing.

Based on the analysis of disease incidence, disease risk factors, clinical routes and diagnosis and treatment fees,the health insurance carried by the company builds a disease risk model based on a large number of credible medical data, EZ-Doctor provides insurance design for different risk groups, guides product service terms and pricing design,and realizes real insurance accurate pricing.

When a medical event occurs, smart contracts are used to trigger insurance audits, automatic claims and settlement, enhancing the insurance customer experience. In the later stage, with the help of the growing number of users and insurance claims information, we analyze the cost factors affecting the medical costs of the insured population through big data analysis technology, so as to fine-tune the control of medical expenses while ensuring the medical quality and service experience.

Landing Application

At present, EZ-Doctor has reached cooperation with a number of listed biomedical enterprises in China. With the help of blockchain technology, it helps enterprises establish their own financial system, build a distributed life bank, help industry development and improve national health.

High-end physical examination: user information on the chain, customized private health report-on-the-chain.

High-end medical beauty: build a medical beauty certificate system to realize the distributed social purchase service of digital ecommerce. Antiaging health care: product supply chain management, commodity traceability, to protect the beauty of women.

High-end members: provide value-added services for enterprises and establish a high-end biotechnology certification system.

Data source: Beike biology, Huarong securities

Bioengineering: protect the copyright of scientific research achievements, cooperate with the authorities of well-known institutions, and provide complete services on the chain. Immunocell storage therapy uses token in the system.

Immune cell storage therapy, as a new method of disease treatment, has been highly concerned by the global medical community. It is reported that the cure rate of cancer in Japan is 90%, while that in China is less than 20%. The basic reason is that there is a large number of immune cell bank in Japan, because the immune cell bank is very important for tumor treatment. The cure rate of cell therapy is very high.

Although this method is still in the development stage, it has good performance in limited clinical practice, which may be the significance of immunocell storage therapy.

1.Effective treatment of tumor

Treatment technology can effectively kill cancer cells. The curative effect is better than that of immunotherapy. At present, cell immunotherapy is the most promising method to cure tumor.

2.Improve immunity

The stored young and functional immune cells are planted in the body, and these immune cells continue to grow in the body, replacing the aging immune cells, and then improve the immunity of the body, and reduce the occurrence of various diseases.

3. Rejuvenate the body and delay aging

After planting, the newly grown immune cells will maintain the functional state when they are collected and stored, which will rejuvenate people and delay aging.

4.Prepare for precise treatment of various diseases

With the rapid development of science and technology and medical level, the ability of human beings to transform and use cells has been improved. It is expected to use the stored immune cells "seeds" in the future, and customize more and more accurate treatment of major diseases for the depositors.

The significance of immunocell storage therapy can be said to be a continuation of human life, which will make great contribution to the extension of human life. There is only one life for human beings, but a longer life will surely bring more value to human beings. So immunocell storage therapy may be another breakthrough in human civilization.

EZ-Doctor has realized the popularization and use of immunocell storage therapy through using token in the process of immunocell storage therapy. The platform sets the immune cell storage project as fixed total amount. Enter the data of consumers and data in the cell storage process into the blockchain certificate, and generate a certain number of digital certificates, which are used as the electronic vouchers for consumers to purchase cell storage items. The digital certificates have the following functions:

1. Medical care

Applying the token allows users to redeem items at the hospital and get more healthcare services.

2.Shopping

Users can exchange products on the EZ-Doctor platform, and use EZ-Doctor to transform cell storage from a luxury product that requires an education market to a fast-moving consumer investment product. This will be the foundation and future of the entire industry. Cells are the origin of life, data is the power of the world, and blockchain is the world's production relationship. The combination of the three will explode into a huge potential.

Economy System

In order to better achieve the core goal of global medical level homogenization, EZ-Doctor has built a complete economic system, covering the main participants in the medical industry chain including patients, doctors, medical institutions, pharmaceutical companies, insurance, technical service providers, etc, and through blockchain technology, medical data and medical knowledge can flow in the economic system at a price. Work with well-known global digital currency partners to provide incentives for all participants in the platform and help all participants pay and settle across the globe.

Design Ideas

Design Background

Through the transformation and upgrading of the blockchain smart contract, EZ-Doctor enables doctors to share the medical knowledge in their minds, assist medical practitioners in diagnosis and treatment services, and benefit more patients.

EZ-Doctor promotes the flow and dissemination of medical knowledge, enlarges the value of medical data infinitely, and fully solves the problem of unbalanced global medical resources. At the same time, EZ-Doctor realizes the trusted interaction of medical data through blockchain technology, breaking the deadlock that medical data are isolated from each other and cannot be integrated. EZ-Doctor will cover advanced medical knowledge products to all corners of the world through a perfect data interaction platform, making it possible to homogenize the medical level worldwide.

Design ideas

The economic system of EZ-Doctor is designed to achieve the core goal of homogenizing the global medical level of EZ-Doctor. Through cooperation with digital currency partners, doctors' knowledge and medical data can be presented as value and flow as digital currency. Through The introduction of digital partners to build a comprehensive multi-win sharing economy system, so that all participants can get the bottom and share the benefits. The core goal of EZ-Doctor multi-win sharing economic system is to improve the income of practitioners and institutions, reduce the cost of patients, and help EZ-Doctor achieve the core goal of global medical level homogenization. EZ-Doctor multi-win sharing economy system will provide kinetic energy for all links of the whole platform medical industry chain through the incentive and sharing mechanism of the general certification, forming a set of continuous flow and expanding economic cycle system.

Users

Patients: Patients who need help from diagnosis and treatment services on EZ-Doctor platform.

Diagnosis and treatment service provider: Doctors and institutions providing diagnosis and treatment services for patients on EZ-Doctor platform.

Medical knowledge sharers: Doctors and experts who share medical knowledge and form smart contracts on the EZ-Doctor platform

Medical data contributors: Participants who provide meta-data for EZ-Doctor, including patients,doctors, medical industry institutions, and etc.

Technical service provider: participants who provide technical services for each link of EZ-Doctor, including algorithm provider, computing power provider, storage provider, tool developer, etc.

Medical industrial institutions: pharmaceutical companies, insurance companies, medical equipment manufacturing companies, etc.

Currency

Application Service Credit (Application Service Credit, ETET)

It is used to pay for all medical services, algorithm services, data asset exchange and other application services on the EZ-Doctor platform.

ETET requirements:

EZ-Doctor is a kind of stable currency, which is to be selected among the global famous stable digital currencies and partners providing customized stable currency services for EZ-Doctor platform, such as USDT, TUSD, GUSD, and etc.

Computing Service Credit, ETEB

It is used to motivate computing services, bookkeeping services, settlement services and user contributions on the platform, and pay for computing services.

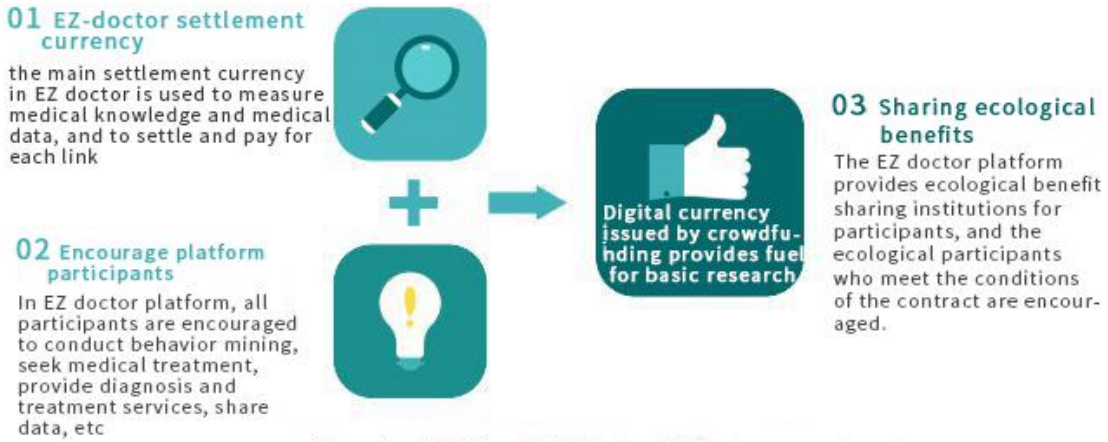
ETEB requirements:

ETEB is a kind of digital currency. It plans to select the best partners among the world famous digital currencies, the world famous digital currencies, the customized digital currencies for EZ-Doctor platform and the incentive shares for EZ-Doctor platform participants, such as ETH, BCH, CONFLEX, SEELE, and etc.

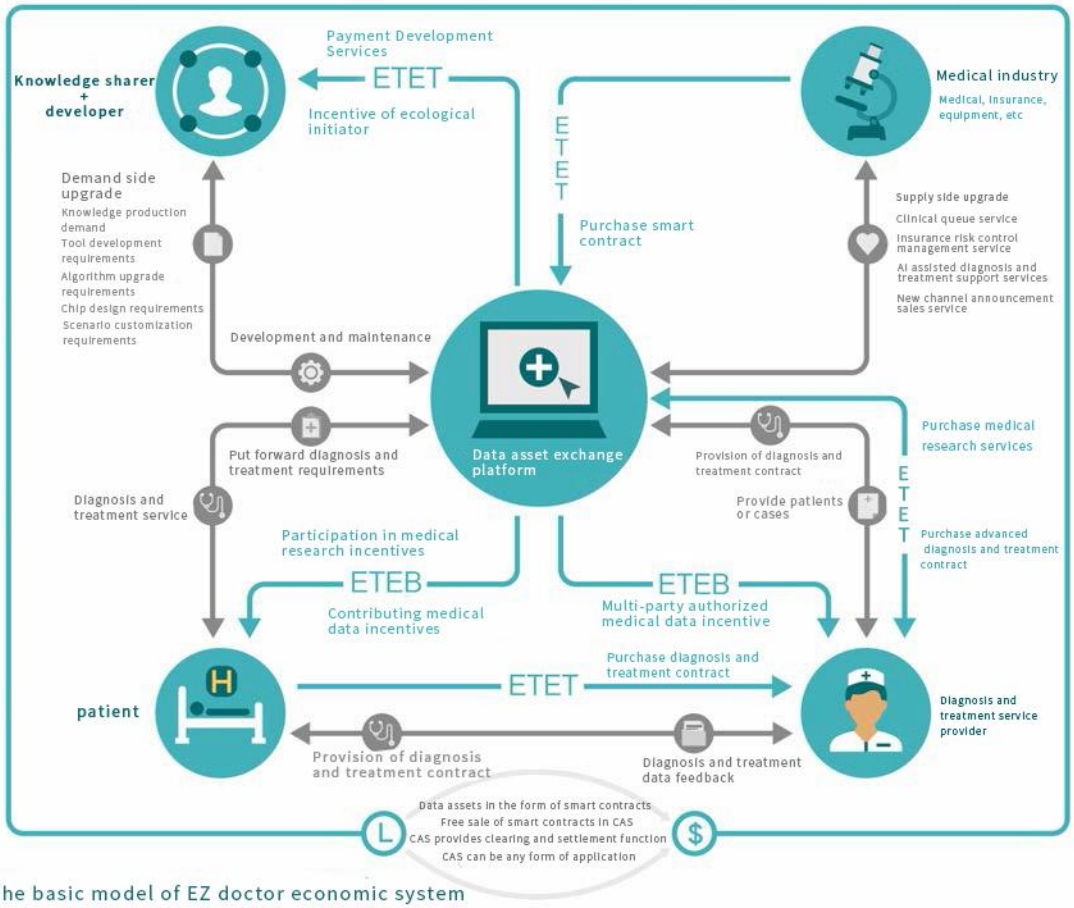
In the EZ-Doctor platform, scientists participating in research no longer need to be in the same country or region, and can use ETET to make payments and settlements across currency circles. ETEB becomes an economic link for knowledge connection, allowing medical data to flow.

The EZ-Doctor platform uses ETEB to incentivize platform participants, thereby reducing the cost of industrialized dispatch and adjusting the cost structure of medical services from treatment to diagnosis. Doctors share knowledge through production contracts to obtain greater benefits and long term economic incentives. Medical costs can be reduced by obtaining ETET.

The EZ-Doctor platform provides a mechanism for sharing ecological benefits to participants. According to the contract, the ecological participants can share the ecological benefits through ETEB.



The role of ETET and ETEB in the EZ-Doctor economic system



The basic model of EZ doctor economic system

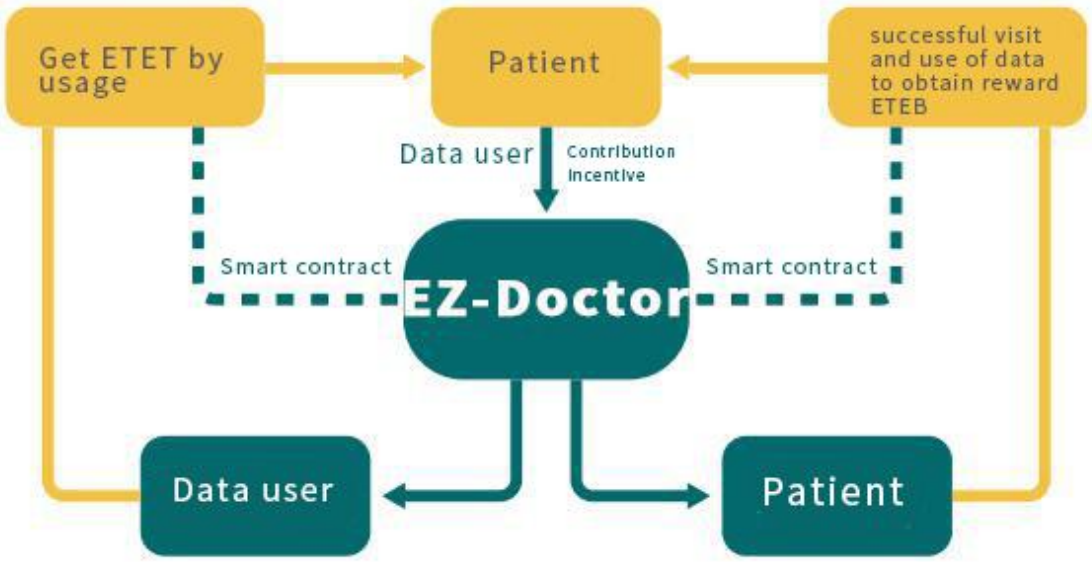
Basic Model

Through ETET and ETEB, we connect the participants in the platform to promote the healthy development of the entire ecology. The specific ecological model is shown in the figure: Patients receive ETEB rewards by contributing medical data and participating in medical research. The obtained ETEB can be converted into ETET to purchase medical contracts and enjoy medical services. It can also be used to purchase related health services. EZ-Doctor has now reached a cooperation agreement with a third party insurance institution, and can directly purchase medical insurance services through ETET.

As the main body of medical service providers, doctors can contract their medical knowledge,create smart contracts, and sell and obtain ETET in the contract store. ETET can also be obtained by providing diagnosis and treatment services to patients. The obtained ETET can be used to purchase medical research services and more advanced diagnosis and treatment contracts. The third party organizations in the medical industry, such as medical, insurance and medical equipment providers can obtain medical data through purchase contracts, participate in clinical cohort studies, accelerate R&D efficiency,and provide risk control management services for patients. Developers of EZ-Doctor platform can cooperate with doctors to contract more medical knowledge, develop corresponding medical tools, and obtain ETET rewards based on data provided by EZ-Doctor platform and diagnosis and treatment services based on artificial intelligence.

Participants rewards

Patients

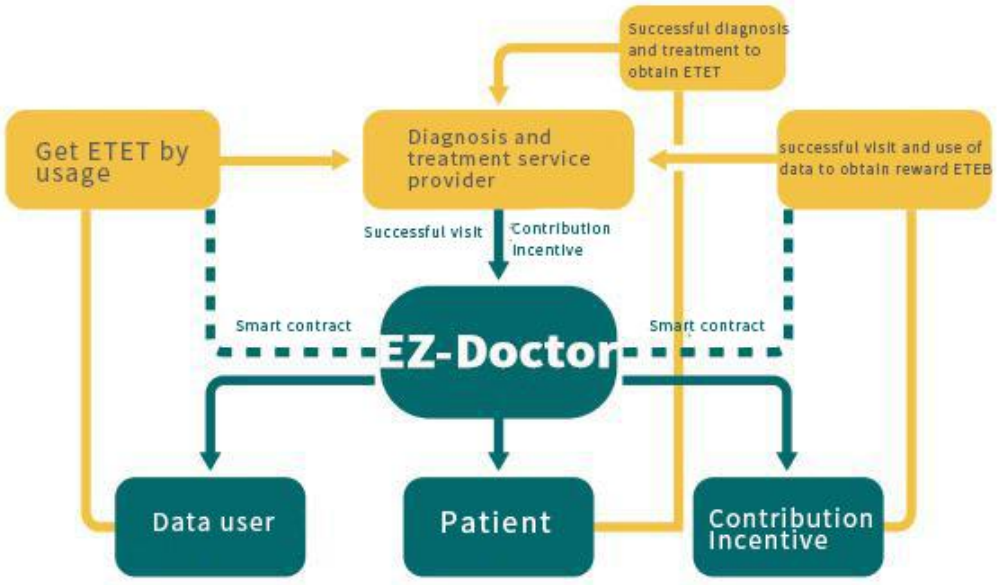


After patients have successfully visited EZ-Doctor platform and contributed their own medical data, they can obtain multiple benefits.

- After the patient's data is called by the EZ-Doctor platform smart contract, the paid use fee ETET can be obtained.
- When the patient's data is called by the EZ-Doctor platform smart contract, ETEB incentive can be obtained.
- Patients can get ETEB incentive after successful visit in EZ-Doctor platform.

Patients can continuously obtain ETEB on EZ-Doctor platform through their own medical behaviors and behaviors of contributing medical data, thus greatly reducing the cost of diagnosis and treatment.

Diagnosis and treatment service provider

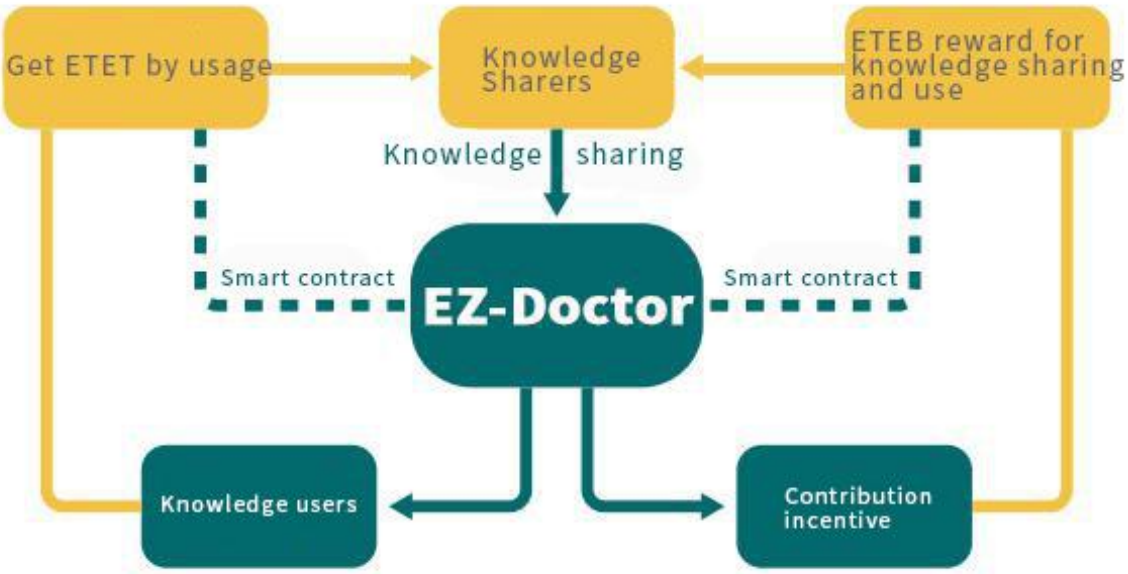


Diagnosis and treatment service providers can obtain multiple benefits by diagnosing and treating patients on EZ-Doctor platform and sharing medical data authorized by patients.

- After providing diagnosis and treatment services to patients on EZ-Doctor platform, the providers of diagnosis and treatment services receive ETET fees;
- After the medical data shared by the diagnosis and treatment service provider is called by the EZ-Doctor platform smart contract, the paid use fee ETET can be obtained;
- The medical data shared by the diagnosis and treatment service provider can get ETEB incentive after being called by the smart contract of EZ-Doctor platform.
- After the successful diagnosis and treatment of patients in EZ-Doctor platform, the diagnosis and treatment service providers can obtain ETEB incentives.

Medical providers can continue to get ETET and ETEB on the EZ-Doctor platform through their own diagnosis and treatment or patient's authorization to contribute medical data.

Medical knowledge Sharers

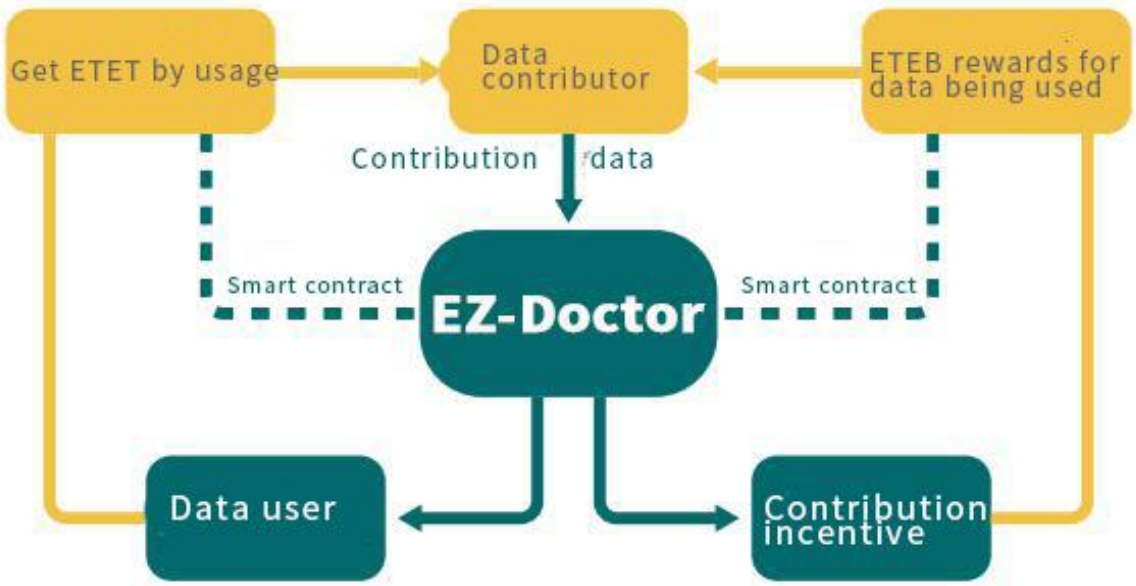


Medical knowledge sharers share their medical knowledge in the form of contracts on the EZ-Doctor platform, so that medical knowledge can flow and multiple gains can be obtained;

- The smart contract of the medical knowledge sharer can be used by the users of the EZ-Doctor platform to obtain a paid usage fee ETET;
- Medical knowledge sharers' smart contracts can be rewarded by ETEB after being called by users of the EZ-Doctor platform.
- Medical knowledge sharers can obtain ETEB incentives after successfully creating smart contracts.

Medical knowledge sharers can continue to receive ETET rewards and ETEB incentives on the EZ-Doctor platform through their own medical knowledge sharing behaviors, so as to realize the value of their medical knowledge and contribute to the improvement of medical standards.

Medical Data Contributor



Medical data holders can obtain multiple benefits by contributing data (meta-data) to the EZ-Doctor platform after authorization by the patient.

- After medical data is called by the EZ-Doctor platform smart contract, contributors can get paid ETET;
- Contributors can get ETEB incentives after medical data is called by the EZ-Doctor platform smart contract;

By contributing data on the EZ-Doctor platform, you can get ETET rewards and ETEB incentives. The value of medical data can be fully reflected on EZ-Doctor, while breaking the barriers of trust and improving medical standards.

The roles of ETEB and ETET on EZ-Doctor platform

The role of ETET

In EZ-Doctor, patients can get the best diagnosis and treatment service by paying ETET. The diagnosis and treatment service provider can obtain the smart diagnosis and treatment contract from EZ-Doctor by paying ETET, which is used for the diagnosis and treatment service of patients. third party organizations in the medical industry, such as medical, insurance, and medical equip-equipment providers, can call medical data and smart contracts in EZ-Doctor for research and development of new equipme-nt and drugs, and also provide risk control management services for patients. knowle-dge sharers in EZ-Doctor convert their medical knowledge into medical smart contracts by paying ETET, and obtain the approved medical smart contracts for the demanders in the platform. ETET is the transaction settlement currency in EZ-Doctor system, which requires high stability.

The role of ETEB

All participants need to use comput-ing services in data transaction or data asset transfer. In this process,they need to spend ETEB. ETEB is the burning currency of computing services in EZ-Doctor system. With the growth of data transaction demand, the value of ETEB will also increase.

All participants in the EZ-Doctor economic system pay for the ETEB, spend the ETEB to obtain data, contracts, services, etc, to meet their own needs, while reaping the ETET revenue, ETET awards, and the business growth of the EZ-Doctor platform will continue to provide momentum for the EZ-Doctor economic system cycle.

Circulation and Expansion

Patients, diagnosis and treatment service providers, knowledge sharers, and data contributors are the basic components of EZ-Doctor. The rich ETET revenue and ETEB incentives of EZ-Doctor enable the EZ-Ddoctor platform to quickly complete the original accumulation of medical data.

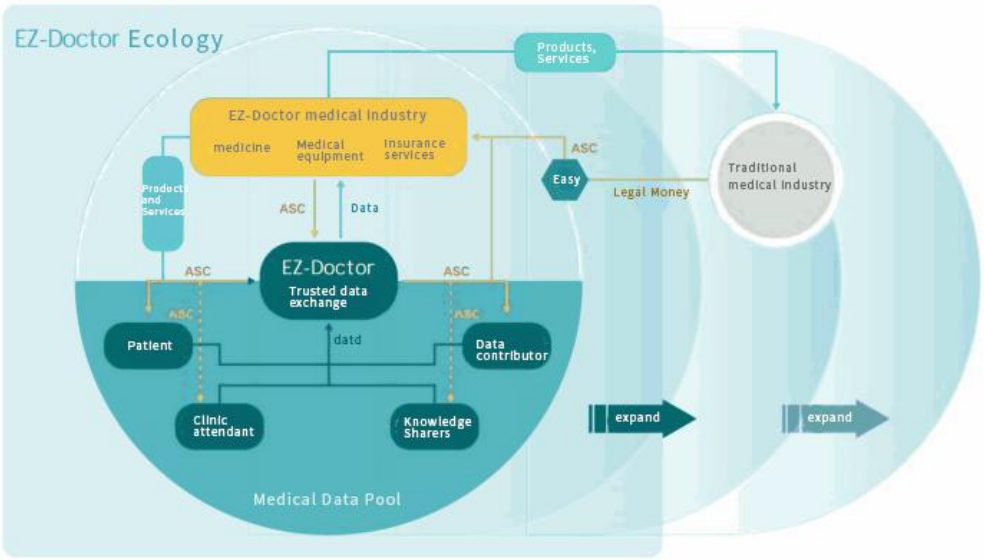
The demand for medical data of the third parties in the medical industry, such as medicine, insurance, medical equipment providers, can be met through ETET purchase contracts on the EZ-Doctor platform, or through the payment of ETET to participate in clinical cohort research to speed up research and development efficiency, and with the support of EZ-Doctor platform to produce better products and services.

Through ETET and ETEB, EZ-Doctor platform connects patients, diagnosis and treatment service providers, knowledge sharers, data contributors, pharmaceutical companies, medical equipment manufactu-rers, insurance service providers and other industrial institutions, forming a cross border cycle from traditional medical industry to blockchain medical industry.

Medical industry structure obtains data through EZ-Doctor, develops better produc-ts and services to provide customers in traditional medical industry to obtain legal currency income, and legal currency enters EZ-Doctor to purchase more data and services through exchange to ETET, forming a virtuous circle.

At the same time, the ETET provided by medical institutions is paid to multiple basic builders in the EZ-Doctor system, and the basic builders gain income again, continue to expand the scale of the medical data pool, and continue to expand the scale of the EZ-Doctor ecosystem through circular linkage with industrial institutions.

EZ-Doctor Ecology



EZ-Doctor Circulation and expansion of the multi-win sharing economy system

Super Nodes

Super developer Incentives

Digital currency partners working with EZ-Doctor need to provide a certain amount of money for super developer incentives. Super developers are the owners of platform smart contracts, and super developers are incentivized according to a certain period. Each time there are a certain number of super developers get incentives, developers comprehensively measure scores according to the dimensions of smart contract calls, transaction volume, user ratings and other dimensions in the cycle, and incentivize according to the top super developers in the current period. The target population targeted by super developers is top medical talents in various medical fields around the world, and hopes to allow target users to share medical knowledge through the incentive system. EZ-Doctor will invite super developers to participate by invitation and registration.

Super Data Nodes Incentives

Digital currency partners working with EZ-Doctor need to provide a certain amount of incentives for super data nodes. Super data nodes are stimulated according to a certain period. Each time a certain number of super data nodes get incentives.

The super nodes comprehensively measure the scores according to the data scale, data transfer times, user evaluation scores and other dimensions within the period, and the scores on the top of the current ranking super data nodes are encouraged.

Data quality is an important indicator for evaluating super data nodes. Data quality requires strict data audit standards and professional reports. The more data is audited, the higher the value is. The score of the data approval organization selected by the data node also has an important impact on the data value.

The target population of the super data node is the institutions and organizations with a large number of medical data in the world, hoping to make the target users contribute medical data through the incentive system. EZ-Doctors platform will invite super data nodes to participate through invitation and registration.

Super Audit Node Incentives

Digital currency partners working with EZ-Doctor need to provide a certain amount of incentives to be given to super audit nodes. According to a certain period of incentives, every time there will be a certain number of super audit nodes to get incentives.

The super audit node performs comprehensive scoring based on multiple dimensions such as the number of audit stars, audit report quality, and audit efficiency during the period. Incentives are based on the current rankings super audit nodes.

Ecosystem

At present, there is a serious problem of uneven distribution of medical resources in the medical industry, not only in the ability of patients to obtain medical services, but also in the serious fragmentation of data in the medical industry chain. The EZ-Doctor ecosystem we have built includes two layers: the empowerment ecosystem layer and the innovation ecosystem layer, which can break the data fragmentation, promote medical business innovation, achieve the homogenization of medical resources, and be involved in industry, academic, and government officials. Everyone can enjoy the same high-quality medical services anytime, anywhere, and on demand, without too much economic risk or danger of falling into poverty, and ultimately achieve universal health coverage.

Medical Industry Analysis

In terms of business, the medical industry industrial chain can be divided into 6 layers:

(1) Diagnosis and treatment business layer the main participants include patients, doctors and medical institutions.

Receiving medical services is a basic requirement for the survival and development of billions of people around the world, so the business diagnosis and treatment layer is also the business layer with the most data interaction and deposition. However, it also faces serious problems, such as uneven distribution of medical resources and hidden dangers of data security.

(2) Circulation business layer, the main participants include distributors and logistics providers of medicine and medical equipment, etc.

In addition to conventional medicines and equipment, there are also logistics needs in special scenarios such as rare type blood and organ transplantation. These important medical items are highly time sensitive and pose a high challenge to logistics.

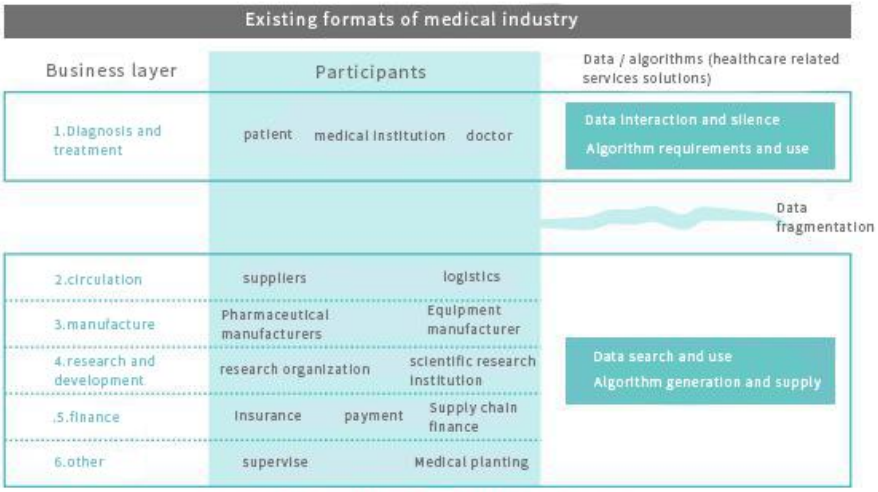
(3) Business layer, major participants include pharmaceutical manufacturers and medical device manufacturers.

They are an important part of the medical supply chain and have certain sensitivity to price fluctuations in macro-economic environmental factors such as pharmaceutical raw materials and equipment raw materials.

(4) R&D business layer,the main participants include various scientific research institutions and R&D organizations.

It includes not only the R&D departments and institutions of profitable enterprise organizations, but also scientific research institutions and R&D teams with scientific and educational attributes. Medical research and development have high thresholds, long cycles, and high risks. Not only do you need a strong academic background and excellent scientific research infrastructure, but you also need to carry out a thorough and time consuming test plan to enter the clinical experiment stage, test a large number of samples and track and collect important information and data.

(5) Financial business layer, the main participants include insurance, payment and other financial service providers.



Current situation of medical industry

Financial service providers run through the medical industry chain, for example: there are a large number of medical insurances for patients at the medical level, and there will be corresponding supply chain financial service providers at the circulation and manufacturing levels. They need to get through all the links, gather a lot of data and provide corresponding financial services on this basis.

(6) Others, major participants, including regulators, etc

The regulator has a heavy responsibility and needs to manage participants in the entire pharmaceutical industry chain. In the existing medical industry ecology, there is an important problem to be solved urgently: uneven distribution of medical resources. The uneven distribution of medical resources is manifested in two aspects:

Firstly, from the perspective of the supply and demand of medical services, the uneven distribution of medical resources is reflected in the patients' access to medical services. In countries and regions with leading socioeconomic development, the medical industry is developed. Whether it is medical research, diagnosis and treatment, or financial services, the surrounding services and other resources are relatively concentrated, and patients can obtain higher quality medical service resources in a timely manner at a lower cost;

However, in countries and regions where social and economic development is relatively backward, the supply of medical service resources is seriously insufficient, and the quality of medical care is low. Patients cannot obtain high quality medical resources or the cost of obtaining high quality medical resources is high. A disease can often lead patient and the family to poverty or bankruptcy. This situation seriously threatens the overall social stability, prosperity and sustainable development.

Secondly from the perspective of the supply and demand of data assets, the uneven distribution of medical resources is manifested as severe data fragmentation. Specifically, at the diagnosis and treatment level of the medical industry, billions of patients have direct contact with medical institutions and doctors, resulting in the largest amount of data interaction and deposition.

These data have important value and are needed by participants at other levels in the medical industry chain. For example, pharmaceutical developers and scientific research organizations need a large amount of patient data to support research to provide better medical services. Insurance and other financial organizations need a large amount of patient data to provide more reliable financial services.

Supervision requires a large amount of data to grasp the situation, disaster response capabilities, and etc.

However, in the past technical environment, there is no large scale, safe and reliable data exchange and sharing mechanism, which leads to the fact that these data are not legally and efficiently circulated between the supplier and the demander. Therefore, not only the value of data has not been fully mined, which limits the generation and supply of algorithms, resulting in the algorithm demand can not be met, but also a large number of illegal phenomena such as data leakage and data resale and theft, which makes the data ownership and use right ambiguous, and seriously infringes the legitimate rights and interests of the data owner.

Ecology System

Ecology outline

As a whole, the EZ-Doctor ecosystem consists of two layers and an ideal.

The first ecological layer is the empowerment ecological layer, which revolves around breaking down data barriers and realizing trustworthy data transactions. EZ-Doctor takes building a trustworthy data exchange platform and computation power center as the core, specializing in medical treatment as the entry strategy and smart contract store as the important application, and cooperates deeply with global digital currency partners to provide application services ETET and computing services credit ETEB for the EZ-Doctor platform, realizing trustworthy data sharing and empowerment for the medical industry, and enabling the free circulation of digital assets.

The second ecosystem layer is the innovation ecosystem layer. Based on the EZ-Doctor platform and with ETET and ETEB as the media, EZ-Doctor promotes the development, application and promotion of DApp in various medical business scenarios, promotes the continuous innovation of medical industry business and finally realizes the reconstruction of medical industry business model.

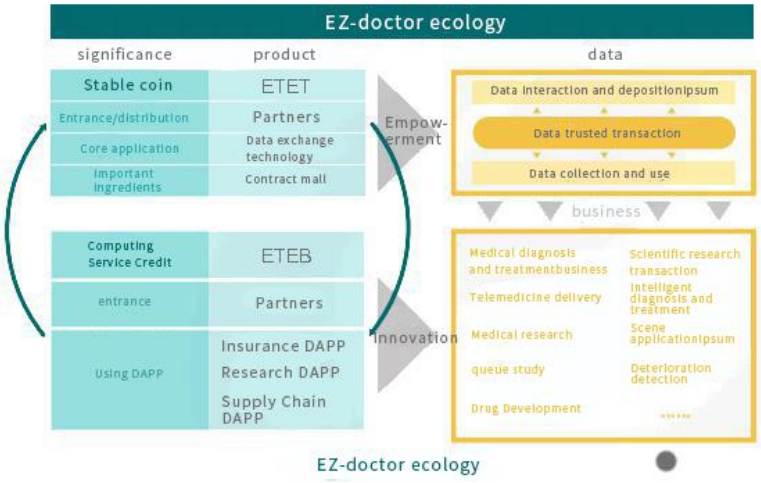
Through the two layers of ecology, EZ-Doctor will establish a highly inclusive, innovative and positive cycle ecosystem to realize the homogenization of medical resources distribution.

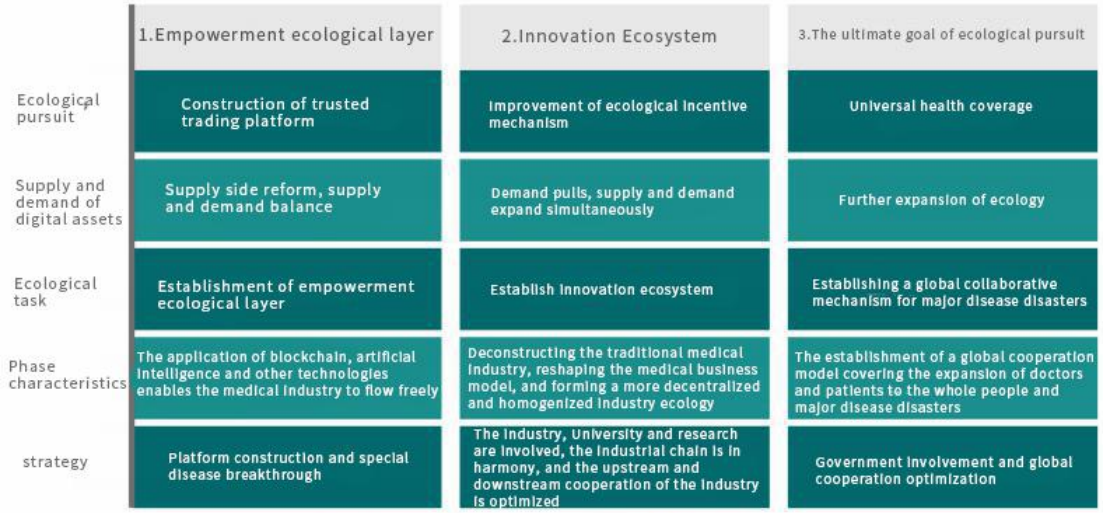
In this ecosystem:

(1) Information and data can become assets that can be legally traded through right confirmation.

(2) Information data assets can realize circulation and realization through supply and demand matching.

(3) All ecological participants can be encouraged to form a positive cycle.





Ecological connotation of EZ-doctor

An ideal is the ultimate ideal pursued by EZ-Doctor ecology to realize the health coverage of the whole people. After being involved in industry, university and research and reshaping the whole industrial chain of the medical industry, EZ-Doctor ecology will further expand to government officials, actively arrange the major disease disaster cooperation mechanism of governments around the world, and pursue the goal of expanding the target patient groups to the whole people, so that everyone can enjoy the same quality of medical services at any time, anywhere and on demand, without too much economic risk or poverty risk.

Economic significance of Ecology

1.The dilemma of supply and demand of digital asset

The data has a value in use after it is produced, and until someone in the market is willing to pay for it, the data is given value. The success of data transaction refers to the completion of the realization of the value of the data. The data owner obtains the value of the data at the expense of transferring the value in use of the data to the data user.

However, due to the inability to guarantee trust,under the existing technical conditions, the use of data assets means possession. "Data open", " Data transaction", "Data sharing" and "Data exchange" are almost equal to "data disclosure". The owner of the data is not necessarily the user of the data, but the user of the data must be able to obtain the ownership of the data. The right to use the data cannot be distinguished from the ownership. When the owner opens the data owned to other entities, it will face the risk of data disclosure. In this case, whether it is the data assets formed by enterprises, hospitals and other organizations, or the data assets formed by patients, consumers and other individuals, it is more of a kind of "pseudo asset". Once it is opened for use, it is leaked, not only the privacy can not be effectively protected, but also the continuous income can not be achieved through the circular transaction of data.

Therefore, the owners of data are not willing to trade data, which results in the contradiction between supply and demand of digital assets. First, massive data is generated in real time, and the production of data is very abundant; correspondingly, social development and innovation are carried out in real time, and all social participants, such as commercial and scientific research institutions and governments, have a strong demand for data. They need massive data to produce and update algorithms, and further meet the needs of other users of digital assets. However, between data production and data demand,

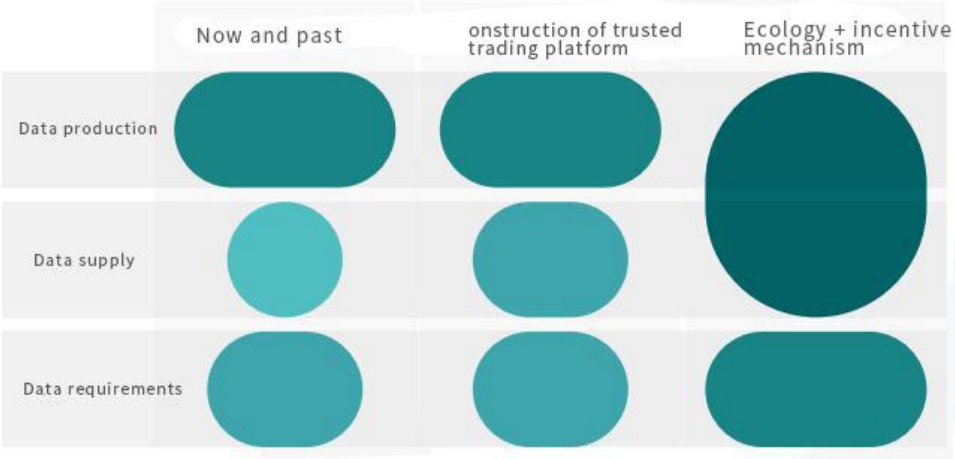
no one can guarantee that data can be traded safely and credibly as a commodity, which leads to the scarcity of data supply, the low level of data value mining, and the limited provision of other digital assets such as algorithms and other medical service solutions; secondly, the production of data is very abundant, The demand for data is very strong, and the phenomenon of data leakage and illegal reselling is very serious.

All of these are rooted in the fact that the right to use and ownership of data cannot be separated, resulting in the separation of the three links of data production, supply and demand, and the inability to form a joint force, and further leading to the supply dilemma of the entire digital assets, resulting in the high cost and slow development of the entire digital assets exchange market.

2. The impact of EZ-Doctor ecology on the supply and demand of digital assets

In the initial stage, the EZ-Doctor ecosystem has not been established, and the technologies of artificial intelligence, big data and blockchain are relatively elementary. There are a lot of data production and potential data demand. However, due to the lack of data supply, data demand is limited.

In this stage, there are two problems and difficulties: (1) the data is not fully mined; (2) the rights and interests of data owners cannot be protected, and the data cannot be traded safely and reliably. The above two factors together lead to the mismatch between data production and data supply, which makes the data supply very small, unable to produce algorithms and other digital assets, directly leads to the dilemma of digital asset supply and demand,and further limits the development of the entire digital asset trading market. Initial state: data use right and ownership can't be distinguished → data owner rarely supplies → data user demand needs to be met urgently → digital asset supply and demand dilemma → digital asset transaction market develops slowly.



The impact of EZ-doctor ecology on data supply and demand

EZ-Doctor ecology will solve the dilemma of supply and demand of digital assets through two stages of development and evolution, and strive for the development of the third stage to increase social welfare.

(1)The first stage: EZ-Doctor builds an empowerment ecological layer and reforms on the supply side.

The data trusted trading platform clearly distinguishes the ownership and use rights of data, and realizes the unavailability of data assets through technology, thereby reducing transaction costs and liberating data supply. Data assets can be quickly, fairly and securely traded on the platform, and data supply and demand can be matched. As a result, digital assets such as algorithms have been produced and supplied in large quantities, such as medical smart solutions, insurance, etc., and continue to meet the needs of digital asset users.

EZ-Doctor empowers the ecological layer: the establishment of a trusted data trading platform → liberation of data supply → full supply and demand of data → digital asset supply is rising → digital asset supply and demand are satisfied → digital asset trading market is prospering.

(2)The second stage: EZ-Doctor builds innovation ecological layer and pullss demand side

Business innovation under EZ-Doctor ecosystem has completely liberated the demand of digital assets, and will drive the rapid development of big data,cloud computing and other technologies. The business innovation under EZ-Doctor ecosystem has completely liberated the demand of digital assets, will drive the rapid development of big data, cloud computing and other technologies, so that the data value can be fully mined, and the data can finally be produced and supplied on demand.

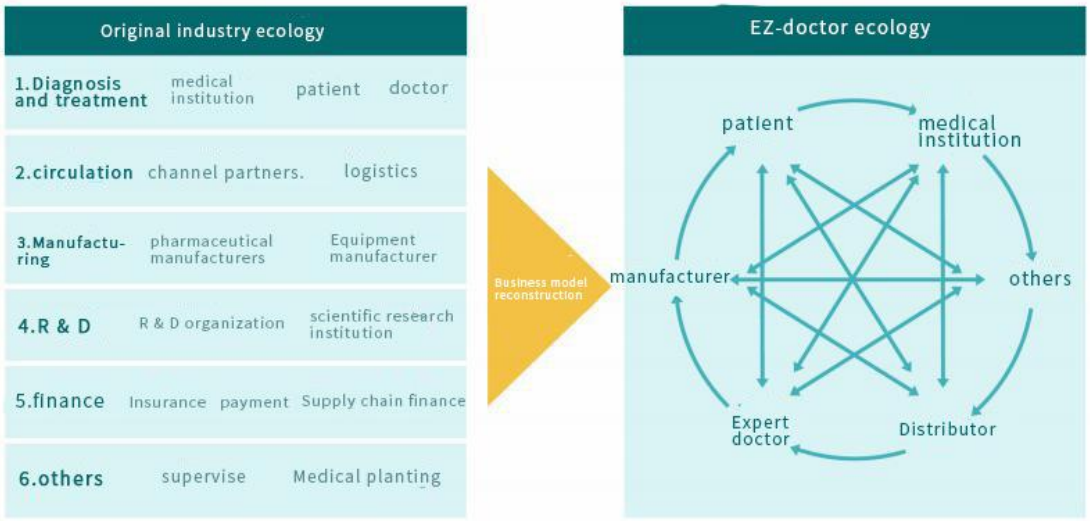
EZ-Doctor innovation ecosystem layer: the establishment of incentive mechanism and business innovation → the thorough stimulation of data user demand → the promotion of data value mining ability → the reduction of data production and data supply gap → the synchronous expansion of data supply and demand.

(3)The third stage: further expansion of EZ-Doctor to maximize social value.

After going through the first two stages, the EZ-Doctor ecosystem will show strong vitality, inclusive openness and unparalleled system efficiency. At this time, EZ-Doctor will actively seek official cooperation with the government, such as introducing the government's emergency response mechanism for major diseases and disasters, and further pursue social welfare and benefits.

3.Ecological value of EZ-Doctor

The value of EZ-Doctor lies in starting with data supply, carrying out supply side reform to expand data supply, creating a good environment by building a trusted data trading platform in the empowerment ecological layer to reduce transaction costs and improve transaction efficiency, and making data owners dare to provide, willing to provide and actively supply, so as to promote the balance of data supply and demand. After that, through the establishment of innovation ecological layer, further stimulate the data demand of users, reverse the data demand to pull data production and supply, form a virtuous cycle, realize the synchronous expansion of the supply and demand of digital assets, and further promote the prosperity of EZ-Doctor ecology.



The transformation of EZ-doctor ecology to medical industry

Ecology vision

EZ-Doctor's mission is to serve the medical industry. The ecological vision of EZ-Doctor is to break the status of data fragmentation in the medical industry, deeply empower all participants in the medical industry,actively promote business innovation in the medical industry, and ultimately help the optimization and reconstruction of the business model of the medical industry, and realize the homogenization of medical resources and the health coverage of the whole people.

There is a recursive relationship between the empowerment ecological layer and the innovation ecological layer of EZ-Doctor ecology. After EZ-Doctor enables the data flow of the medical industry chain in the ecological layer, the accumulation and utilization of digital assets will be more and more. Under the diversified incentive mechanism provided by the innovation ecosystem layer of EZ-Doctor, various DApps to solve the specific scenario needs in the industrial chain will be continuously generated, which will continuously promote business innovation and optimize the cooperation between the participants in the existing medical industrial chain. After a series of quantitative changes and qualitative changes, the original health care industry chain ecology formed under the condition of data fragmentation will be broken, and the participants at all levels of the health care industry will cooperate more closely. The EZ-Doctor ecosystem will promote the optimization and restructuring of the whole medical industry model.

In the medical industry ecosystem shaped by EZ-Doctor

1.For users of data assets, such as insurance, scientific research institutions, etc., they can use but not possess data in EZ-Doctor ecosystem, and can realize the popularization of sensitive data use, so that they can use data smoothly without worrying about data disclosure and related legal risks;

2. For data asset owners, they can use the data tools provided by EZ doctor ecology to realize data standardization, and sell the right to use the data to obtain income and incentives, so that the value of their own data can be fully mined and utilized, and their data can be realized in the market transactions with good income;

3. For the owner of algorithmic assets, in the EZ-Doctor ecosystem ecosystem, knowledge and skills will be converted into algorithms and solutions and marketed, which can realize the convenience and marketization of their own medical knowledge and skills. The universalization of the ideal value of medical treatment allows it to make good use of its own knowledge and realize its own value;
4.Ultimately, for billions of patients, they can obtain the medical resources they need anytime, anywhere, and EZ-Doctor Ecology will achieve universal health coverage, allowing patients to cure diseases and pay for them. Universal health coverage is a concept promoted by the United Nations in 2013. Its goal is to ensure that all people can get the health services they need without the risk of large economic risks or poverty. (WHO20-13)

One of the EZ-Doctor ecology is to build a trusted data trading platform, deeply empower all parties, and actively promote innovation, so that everyone can get the health services they need: Secondly, by establishing a public welfare incentive system and credit system provide patients with phased medical financial products so that everyone can afford them.

Empowerment Ecology Layer

In the EZ-Doctor empowerment ecological layer, deep application of blockchain and other technologies is used to build a credible data trading platform, cut in from specific diseases, and reform the digital assets.

All the complicated and disorderly flow of diagnosis and treatment data will become identifiable,traceable, and tradable, and eventually form a data. asset, breaking the "data island" phenomenon of the medical industry, thereby further improving the efficacy rate of high diagnosis and empowering the medical industry.

Building a trusted data exchange platform

EZ-Doctor can realize the "three rights separation" of data ownership, data use right and data execution right through the use of "secure multi-party encryption operation" and sandbox data transmission technology. The data is not on the chain, only the data index on the chain, the data ownership is owned by the supplier, the data exchange platform does not store the supplier's data, but the data is encapsulated in the sandbox, and only the demander who holds the sandbox key can view the data . In this way, sensitive data can be trusted transactions without creating data leakage, creating value for related parties.

Data center deployment

Based on the computing power of individual and enterprise users, EZ-Doctor will continue to develop new computing resources to the world, improve user data exchange and data computing experience, and create greater value with less resource consumption. At the same time, in order to better serve users, we will rely on partners or professional teams from all over the world to deploy the computing center around the world, so as to ensure that the computing investors can obtain stable income with the least investment.

Establishment of ecosystem with strong expansibility

EZ-Doctor uses a new smart contract technology to completely separate the smart contract which is closely combined with the blockchain, so that each chain can provide services for multiple contract entities, and each contract entity can operate multiple

blockchains, fundamentally solving the heterogeneous collaboration and scalability of the blockchain system, facilitating cross chain access of contracts and generalization of application scenarios. The realization of multi-chain and multi-contract, which can be extended and strong, provides a strong technical support and guarantee for the construction of a reliable data exchange and sharing platform for all parties in the medical industry.

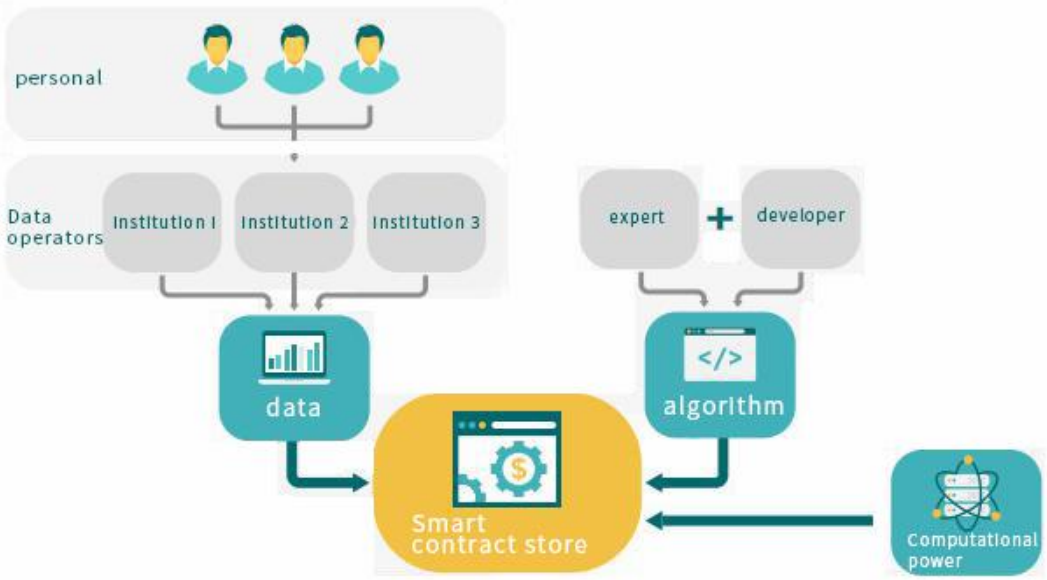
Simple smart contract applications

For smart contract design, EZ-Doctor has introduced a "domino" model that changes smart contract design from hard coded to visual mapping, thus freeing up contract design capabilities to business people. In the management of smart contracts, the three-tier structure of smart contract template, product and machine line contract is used to manage the smart contract, visualize the smart contract inquiry, editing, audit, etc.; In the monitoring of smart contracts, the smart contract can be monitored visually in multiple directions. Visualizing the design, management and monitoring of smart contracts greatly facilitates the promotion and use of smart contracts.

Establishment of digital assets transaction mechanism

EZ-Doctor confirms the digital asset transaction mechanism through "ETEB" and "Smart Contract Store" and "ETET". ETET is used to assist the regular payment and settlement of platform users. Users of digital assets can pay ETEB to the owners of digital assets to obtain the digital assets they want. Considering the user's usage habits, ETEB will refer to a stable digital currency anchored with legal currency, so that users who prefer to use legal currency can better complete the payment and settlement.

The smart contract store is a C2C medical knowledge computing smart contract trading platform with a complete multi-mode external server structure(BAAS service + API service + APP service). Smart contract stores are used to trade digital asset commodities in three categories: algorithm (knowledge), data and computing power, which form fair pricing in transactions:



(1)Algorithmic transaction

Within the EZ-Doctor ecosystem, the medical knowledge and practices of top medical experts are shared for a fee in the smart contract store when they are formalized in a smart contract. By "continuously developing new contracts → pricing smart contracts based on results in the smart contract store transactions → continuing to develop more optimized contracts based on good contracts", EZ-Doctor has created an ecosystem where smart contracts grow from the ground up and gives the contract components industrial value in the smart contract store transactions, inspiring developers to create better smart contracts.

At the same time, based on the smart contract store, we actively empower algorithm developers to provide them with corresponding product components and development tools to enable them to facilitate their cooperation with medical experts and improve the efficiency of algorithm development.

(2)Data transaction

Hospitals, medical institutions and other important data sources will put their own data into the smart contract store after cleaning and sorting, and form fair pricing in the transaction.

At the same time, based on the smart contract store, we actively promote the formation of a primary data trading market. Because the data distribution of the medical industry is multi-level, including the data from individuals, such as the diagnosis and treatment data owned by patients and the health data accessed by ordinary people through wearable devices, as well as the data from the source institutions, such as the data owned by large hospitals and medical institutions. Due to the limited professional knowledge and skills of individuals, it is more likely that hospitals and other institutions will obtain their data from individual customers, collect and sort them, and finally form data that is convenient for transaction and hang them in the smart contract store for sale. This logic is very similar to the rental market. At the beginning, the rental market was dominated by individual landlords.

However, due to professional limitations, with the development of the market, more and more individual landlords gave their houses to long-term rental apartment companies to take care of, and gradually formed a rental market pattern with long-term rental apartment companies as the main suppliers.

Therefore, we respect the rules, actively create conditions to promote the developm-ent of the primary market of data trading actively develop and provide corresponding product components, and empower institutions to transform into bulk asset operators.

(3) Computation power transaction

The provider of the computation power provides it and trades it in the smart contract store.

Innovation Ecosystem Layer

Incentive mechanism

In the innovation ecosystem layer, EZ-Doctor establishes a perfect ecological incentive mechanism to pull the digital assets from both sides, and encourages various DApp developers and innovators to cooperate with the digital asset owners to make full use of the data assets formed in the empowerment ecosystem layer. EZ-Doctor can not only provide a platform for DApp developers and innovators to help them develop and innovate DApp in their business areas, but also provide various DApp application distribution channels and crowd funding development channels for developers and innovators to help DApp developers and innovators realize realization.

Finally get involved in industry, University and research, get through medical industry, and realize the the health of cooperation and optimization of upstream and downstream industries.

Continuous innovation of medical business

Inspired by the EZ-Doctor ecosystem a large number of DApp developers, innovators and computing providers, digital asset providers, and digital asset users have joined in and are growing.

DApps under various specific medical business scenarios will emerge in large numbers to meet the needs of all participants in the medical industry chain and constantly promote the innovation of medical business.

Including but not limited to: DApp for smart diagnosis and treatment, DApp for hierarchical diagnosis and treatment, DApp for telemedicine, DApp for large queue service, DApp for auxiliary diagnosis of difficult diseases, etc.

Road Map

June 2018 — Q1

- Project release and governance structure construction

February 2019 — Q2

- Construction of R & D platform between China, UK and US
- Communication tasks and personnel lock-in of core teams from different countries
- Experiment of Principle model
- Setting up Atlanta R & D Center

August 2019 — Q3

- Test platform online
- Data exchange supporting basic functions
- Contract mall online
- Supporting remote medical treatment
- Holding Global launch conference

February 2020 — Q4

- All functions are complete and the platform is online
- Support the exchange of computational power algorithms
- Mutual mall Online
- Start clinical diagnosis and treatment of major diseases with authoritative organizations
- Integrated medical series production

August 2020 — Q5

- Fusion of multiple batches of special disease data and algorithm
- Integration of data platform and local government
- Diversity of data collected by intelligent hardware
- Cooperating with ministries and commissions to establish relevant training system

February 2021 — Q6

- Research and development of multiple intelligent terminals
- National health cab promotion
- Starting Tumor Rehabilitation Project with the third grade hospital
- Starting automatic collection of biology and gene data

Core Team

Junong technology

The first batch of blockchain R&D enterprises in China, the top six blockchain top 100 enterprises selected by the Ministry of Industry and Information Technology and Tsinghua University, participated in the formulation and discussion of distributed standards by the Institute of standards and planning of the Ministry of industry and information technology, including the chief strategic partner of Guojin public chain under the State Council, the member of Zhongguancun blockchain industry alliance, the member of green industry alliance of the Ministry of industry and information technology, and the Secretary General unit of Guangdong Regional and Innovation Research Association.

JWotch

Tongjie holding is committed to creating a new type of pension model - smart home care in Leling community, the leader of smart watch industry. There are 120000 users, more than 50 branches and more than 300 cooperative hospitals in China. In 2018, it was rated as the smart retirement star product by the Ministry of Industry and Information Technology, the Ministry of Civil Affairs and the Health and Family Planning Commission.

Universal Medicine

Puhui super doctor is the pioneer of domestic medical self-diagnosis system, nearly 100 top medical experts, doctors and scholars of the company, It took 17 years to integrate the unique high-tech artificial intelligence platform and medical knowledge into today's top general medicine, evidence based medicine, medical practice concepts, etc, and carefully build the world's only general medical smart diagnosis platform that can be used in clinical practice, which is the only general practitioner available to everyone at present.

China Guangcai Foundation

China Guangcai foundation is a foundation registered by the Ministry of civil affairs of the people's Republic of China, which is under the charge of the Unification Department of the central government. It was officially established on December 28, 2005. It is to serve social public welfare undertakings and strive to build a health care life circle with urban (rural) communities as the core.

Beijing University of Chinese Medicine

Based on traditional medicine, Beijing University of Chinese Medicine demonstrates the essence of disease from the physical and mental level, spreads the health concept of “integration of body and mind, integration of nature and man, and prevention of disease first”, integrates modern cutting-edge science, and finally realizes the dynamic balance of yin and yang in the human body and human itself, the balance and harmony of the interpersonal social relationship between people and the natural environment in all major systems, the harmony between people and all things. This is the permanent pursuit of human health and wellness.

Normal Technology

After decades of research and development of natural critical normal water, normal science and technology has pioneered the study of water molecular energy and water molecular mechanics. Normal water can break through the cell membrane and blood-brain barrier smoothly, promote the life metabolism activity comprehensively, improve the cell function comprehe-nsively, and increase the cell vitality. It has obvious prevention and promotion rehabilitation effect on many chronic diseases such as diabetes, hypertension, hyperlipidemia, stroke and cancer. It is the best "scavenger" for human body, promoting human health and improving the quality of life.

The distributed life bank

The distributed life bank records the data of consumers and the data in the cell storage process into the blockchain certificate, making cell consumption transparent and price friendly. It has established long-term cooperative relations with Beike biology, Zhongsheng jianba, Yuanneng group, Zhongjian group, Boao International Hospital, Boao super hospital and China Japan Friendship Hospital.

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