LEMONCHAIN

WHITEPAPER

VERSION 1.7

www.lemonchain.io

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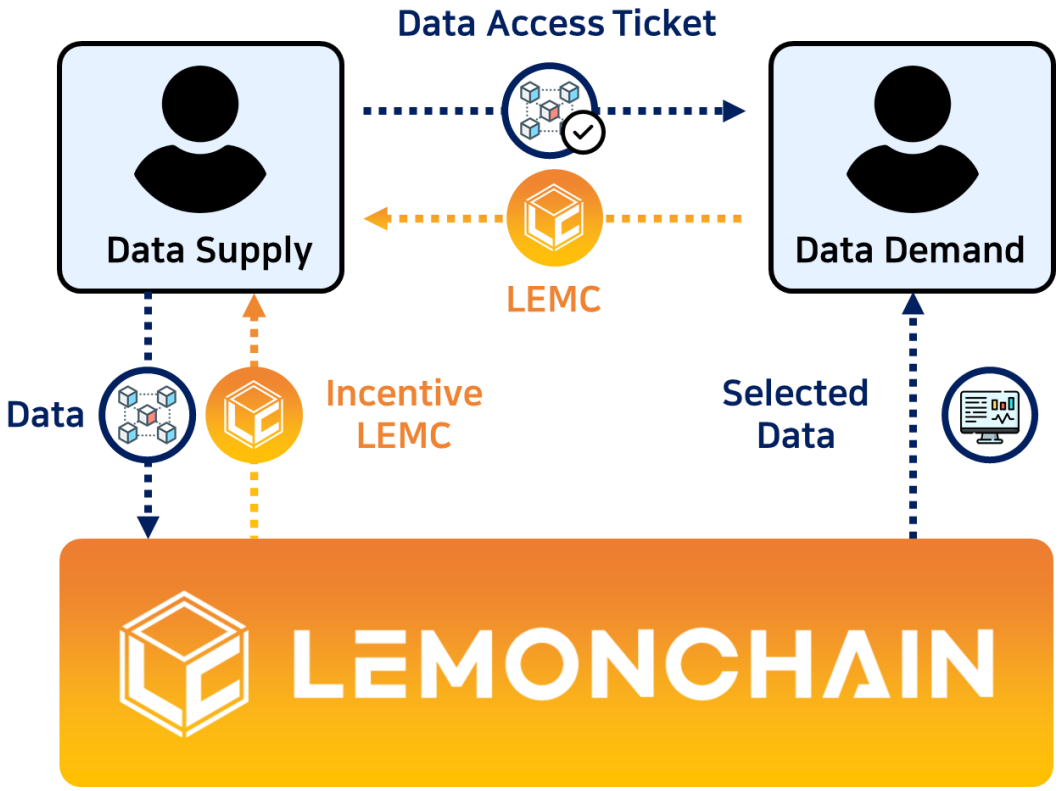
1. Abstract

With rapid convergence of big data, information communication (ICT) and artificial intelligence (AI) technology along with innovative bio technology in the healthcare area, productivity and efficiency of products and services in each of the stages of healthcare area is increasing. Although provision of support to strengthen patient's accessibility to personal health information and for services that provide healthcare data and information centered-around large hospitals began in alignment with such trend, allowing of viewing through utilization of wired and wired communication is also limited to 'viewing of one's own records or confirmation of contents such as issuance of the copies thereof, etc.' and is using aged system.



Accordingly, LEMONCHAIN is striving to create open ecosystem for blockchain-based healthcare data and information capable of centralization of medical records and enhance the awareness of the authority of the administrator of patient. LEMONCHAIN ecosystem has a structure that enables distribution of profits among the interested parties by reducing information asymmetry between medical institute and patient by allowing individuals to easily access their own medical information for utilization of data and by establishing system in which consumers (patient, general public) can participate assertively. In addition, we are planning to establish system for seeking of means of reclassification and differentiated regulation (level of non-identification and anonymization, etc.) of healthcare data and information (general information, non-identified information and sensitive information, etc.) by clearly stipulating the definition and range of as well as specifying the standards for allowing of utilization of healthcare data and information, and regular review of the definition and range of sensitive information.

Therefore, this white paper will analyze the current status and problems of 'exchange and utilization of healthcare data and information', which is the most important resource and infrastructure of smart healthcare ecosystem, and introduce healthcare blockchain network-based LEMONCHAIN ecosystem.

2. Introduction

2.1. Current status of Smart Healthcare Ecosystem

Importance of smart healthcare industry for which digital technology (IT) and AI technology are used innovatively in the healthcare area is being highlighted as the core of innovation in the era of the 4th industrial revolution. By providing smart health management and medical services 'at anytime and anywhere' through the convergence of bio technology, digital technology and AI technology, it is possible to pursue the effects of reducing medical costs, which is currently rising rapidly and markedly due to the trend of aging of population, along with the effect of economic growth.

With the transition of existing treatment-oriented healthcare area into data-based smart healthcare, paradigm of healthcare ecosystem is undergoing changes. The era of the 4th industrial revolution is emerging by being centered-around 'data-based revolution', with concurrent emergence of data-based industries including cloud, internet of things (IoT), big data and AI, etc. In addition, it is possible to build up healthcare big data through integrated linkage of a wide range of data including medical data (EMR), life log data (PHR) and genetic information, etc., and, as such, the smart healthcare industry can provide 'products and services customized to individuals' by utilizing individual's data and information.

In spite of such changes in healthcare paradigm and global innovation environment, smart healthcare ecosystem is yet to be activated.. Since majority of the elements of the healthcare ecosystem including not only Personal Information Protection Act and Medical Service Act but also issues of privacy and healthcare data management, etc. that occur in data economy society are focused on the 'protection of information', there are highly inadequate viewpoints on the utilization of information.

Moreover, although it is anticipated that the quality of life can be enhanced and welfare can be expanded, and lead economic growth by generating new growth engines through smart healthcare, foundation for advancement of the industry is yet to be established due to diversified conflicting situations including domestic and overseas medical information system being operated with medical institutes playing the core role etc.

It is urgent to 'transparently and openly activate the environment to utilize healthcare data and information' within the smart healthcare ecosystem in order to maximize the socioeconomic ripple effects of smart healthcare and to turn it into the growth engine of the future. In particular, activation of smart healthcare ecosystem service to encourage efficient opening, sharing and integrating data and information that are shared and utilized segmentally and linearly is urgently needed.

2.2. Importance of Smart Healthcare Ecosystem

We are entering the era of the 4th industrial revolution with rapid convergence of big data, information communication (ICT) and AI technology along with innovative bio technology in healthcare area.

Medication, medical device and medical service are undergoing evolution into smart medication, smart diagnostic medical device and smart healthcare service, respectively through the hyperconnectivity network

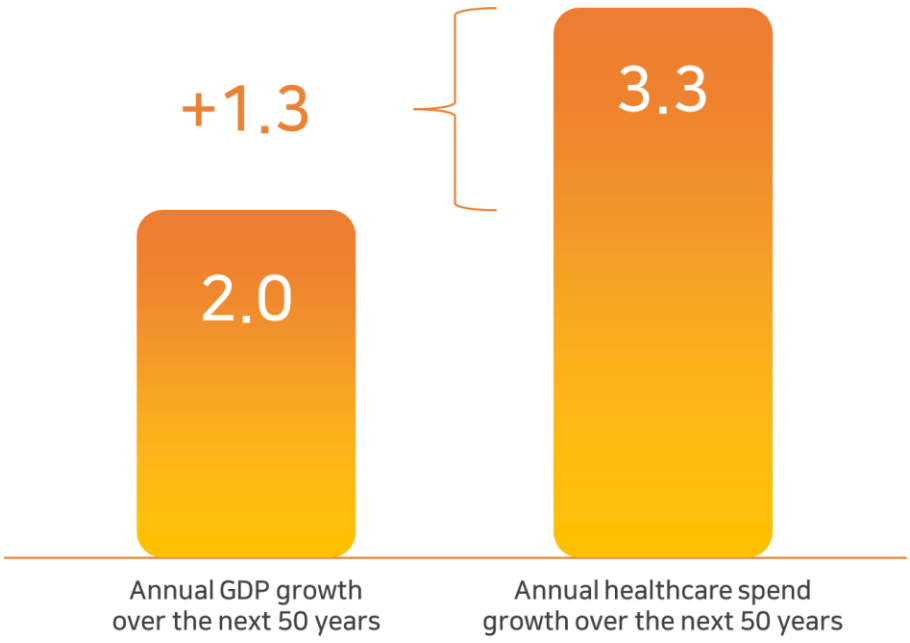
with big data, AI and mobile devices. Moreover, through digitalization and conversion into AI for each stage of value chain in the healthcare area, productivity and efficiency of products and services are being enhanced.

In addition, with the rapid advancement of bio technology and rapid drop in the costs of analysis of health and medical information analysis individuals including genome analysis, etc., there has been rapid increase in the health and medical information of individuals along with acceleration of ICT convergence of health management and medical services.

Suppliers of health management and medical service (hospital and health insurance company, etc.) are assertively utilizing digital technology, and healthcare big data are utilized even in the areas of R&D on new drugs and development of new medical technologies. Smart healthcare companies are developing innovative products and services for the prevention, diagnosis and management of diseases through convergence of technologies, thereby resulting in emergence of business models from diversified perspectives with disappearance of boundary between the service industries.

While the annual average growth rate of GDP of OECD countries for the next 50 years is forecasted at 2.0%, the annual average increase in medical cost is forecasted at 3.3%, thereby needing transglobal countermeasures for such increase in costs. As the burden of medical costs is increasingly rising due to aging of the population, the healthcare paradigm is undergoing changes in overall and the need to reduce medical costs through smart healthcare focused on prevention and management is being highlighted.

<Forecast for rate of increase in GDP and medical costs over the next 50 years in OECD countries>



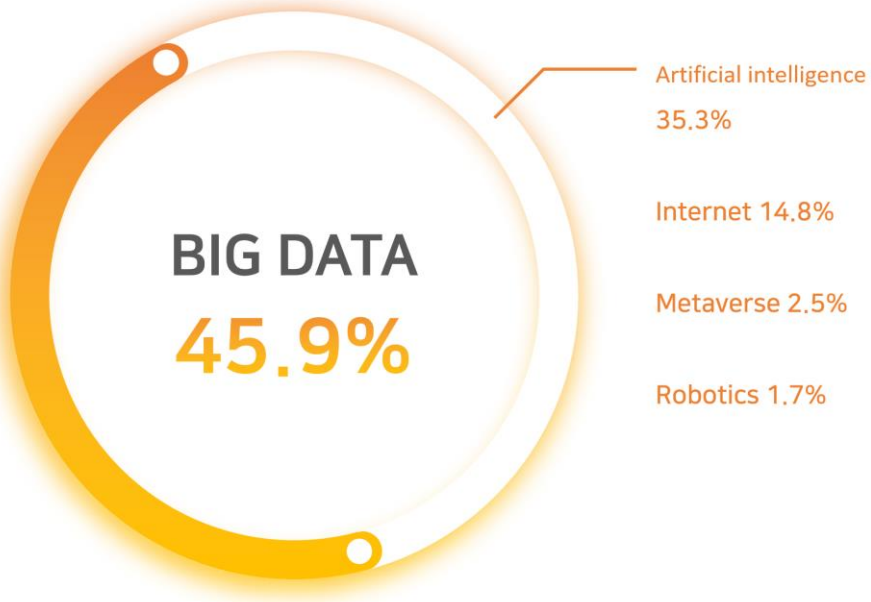
[Source : UK Life Science Industrial Strategy Board(2017), *Life sciences industrial strategy: A report to the government from the life science sector.*]

By distributing the reduced medical costs and economic effects achieved to the interested parties (patient, insurance company and local government, etc.) in diversified formats including provision of incentives through enhance the cost efficiency, it is possible to induce the interested parties to assertively participate in smart healthcare ecosystem.

2.3. Role of Healthcare Data

Healthcare data are the most important resources in the smart healthcare ecosystem and 'efficient exchange and utilization of healthcare data and information' is the most important prerequisite for activation of smart healthcare ecosystem. In particular, it is possible to achieve efficient new drug development and provision of medical services customized to individuals by utilizing healthcare data and information including genetic information, etc.. In addition, the proportion of big data including healthcare data and information among the key future technologies in the area of healthcare is forecasted to be about half.

<Proportion of key future technology in healthcare area>



[Source : National Information Society Agency (2015)]

It is anticipated that big data will increasingly get enlarged with connection of healthcare data and information collected from diversified sensors and mobile devices through internet of things (IoT), etc. Healthcare big data accumulated in this manner are analyzed by AI such as IBM Watson for Oncology for provision of evidence-based customized medical services or utilized in more efficient new drug development, etc.

2.4. Mission of LEMONCHAIN team

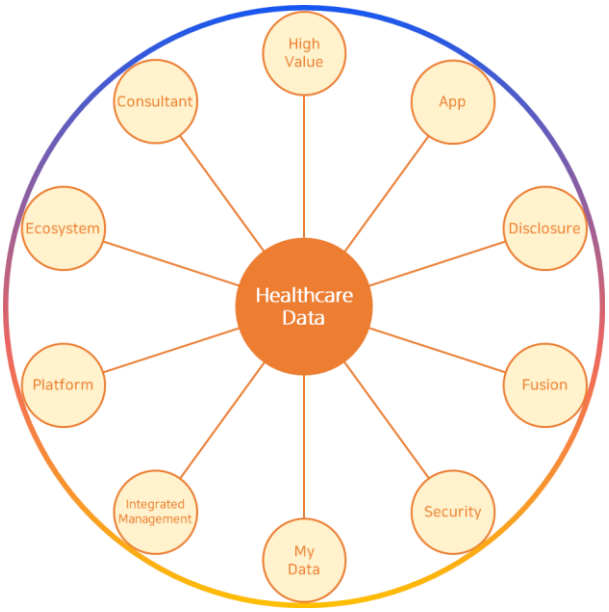
"Enabling the users to access their electronic health records (EHR) through online and safely exchange all their health information through establishment of healthcare data ecosystem capable of mutual operation"

Individuals healthcare data collected through numerous medical institutes and wearable devices have values as assets of digital health management system. It is possible to provide harmonious medical treatment with individual's healthcare data managed with a single set of standards even if it is not by the medical institutes and medical staffs that the individuals usually visited. Moreover, if there is data stored in advance, it is possible to complete insurance claim automatically following remote medical treatment, thereby enabling realization of the role of provision of guidelines to the users including recommendation and delivery of menus appropriate for the individual's data following completion of treatment as well as completion of gene test in prescribed intervals, etc. within the ecosystem.

In order to establish such ecosystem, we are striving to create data ecosystem centered-around the user (including patients and hereinafter referred to as user) capable of protecting the privacy and maximizing the reliability of health information of individuals by developing high-performance blockchain optimized for the distribution and utilization of medical data through utilization of LEMONCHAIN.

LEMONCHAIN ecosystem enables reliable information exchange by achieving decentralization of personal information and conversion into user-oriented lifecycle healthcare ecosystem in the area of healthcare data in order to resolve diversified scientific issues related to healthcare through the ecosystem in short or mid to long-term. Furthermore, 'enhancement of the authorities of the participants' will be researched continuously and intensively.

<Scope of utilization of Healthcare Data that LEMONCHAIN is considering>



3. LEMONCHAIN, New Healthcare Data Ecosystem

Existing electronic medical records (EMR) of the medical institutes will be linked and data will be collected through voluntary data donation of patients in order to build up LEMONCHAIN ecosystem with healthcare data of more than a million individuals.

Patients and general public participating in the ecosystem will be acknowledged as the core values in the building up of data and active partnership relationship rather than passive participant will be established. They will participate in the policy design and supervision as the partners in the establishment of ecosystem for seeking of new consent model discussions and user-oriented access format, etc. together.

In addition, by enabling the patients to easily access their medical information and utilize relevant data within the LEMONCHAIN ecosystem, it is possible to reduce the information asymmetry between medical institutes and patients while participation of patient is increased for consumer-led use of medical system. Patients can views and download their own medical and health records, and share them with other medical institutes or family as well as download and manage their medical information in standardized digital format, thereby significantly alleviate the asymmetry of medical information.

When data are donated, such data will be used in big data analysis or utilization after having deleted the name of the donor or contents that could affect the privacy of individuals in order to safely protect the personal information thereof.

Key goals to be accomplished through LEMONCHAIN ecosystem are as follows:

① Share one's medical information with family, family doctor, medical specialist and nursing caregiver, etc.
② Confirm and tract key information including details of drug administered, vaccination and test results.
③ Utilization of one's medical information at the time of changing doctor or visiting medical specialist
④ Medical examination and treatment by using one's medical information at the time of emergency
⑤ Provision of automatic transmission function for medical treatment records (Push Service) and function for regularly scheduled confirmation of patient's informaiton by a 3rd external medical service providers (Pull Service)
⑥ It is possible for medical institute to automatically transmit the patient's medical treatment records in electronic methods including email or healthcare app. etc., and transmission of medical treatment records between medical institutes is also possible.
⑦ Support data exchange between participants of ecosystem service, support accessing of medical records by the patient, and support exchange of data with insurance payer and transmission of healthcare data to government institutes

3.1. High level of Authority of Data User

LEMONCHAIN ecosystem is composed of mobile device user, diversified healthcare devices and app, hospital and EMR companies, etc. User has the authority to utilize the data and will decide whether to save, access and transmit to other institute.

If the user measures one's biodata through healthcare devices and app, they will be saved in and managed by LEMONCHAIN ecosystem. If the user consents, diversified services within the LEMONCHAIN ecosystem will be

linked with the EMR of hospital and user's biodata. Measured healthcare data and information are saved in the mobile devices of the user first before being saved in cloud upon consent by the user. Health data saved in the specific app installed in the user's mobile devices can also be accessed with the consent of the user. LEMONCHAIN ecosystem adopts Opt-Out format in principle and the format of automatic linkage between hospital system and patient's data with disclosing of the intent of the patient to refuse the utilization of the data thereafter is also scheduled to be utilized.

3.2. Rigorous Management Standards for Services Participating in Ecosystem

Services participating in the ecosystem will be subjected to significant financial penalties if they fail to appropriately protect the personal information, violate requirements notified, specific order related to consent, responsibilities of data controller and processor, and need for data protection evaluation, etc. In addition, approval of the patient (Opt-In[1] format) for the 'personal information requiring considerations'[2] including the medical data is a requisite in principle, and Opt-Out format of providing personal information to 3rd party without clear awareness of the patient is not acknowledged.

Business operator tasked with anonymization of medical information will be limited to corporations who can satisfy prescribed standards including securing of high level of information security and holding of sufficient anonymization processing technology as well as capable of appropriately and definitively execute anonymization for the management and utilization of medical information. Consigned business operator to handle medical information is limited to corporation capable of appropriately and definitively prevent disclosure and damaging of anonymized medical information and execute measures necessary for safe management of other corresponding (anonymized) medical information for participation in the provision of services within the ecosystem.

3.3. Disclosure of transparent data management standards

It is possible to confirm information such as hidden pattern, and unknown correlation, trend and preferences by transparently disclosing healthcare data management standards. Moreover, assist the user and interested parties to make better decisions based on the information provided.

Velocity	Pace at which data is generated	Data Tools	Definition of the meaning of big data analysis tool
Vocabulary	Data model, schema and other terminologies	Variability	Action for dynamic evolution of data source
Validity	Data quality, governance and master data management	Venue	Dispersed heterogeneous data generated from multiple number of platforms
Veracity	Data accuracy	Variety	Types of data different from each other
Volume	Data size	Value	Evaluation of usable data

[1] Opt-In: Format of processing information in accordance with consent of individual in advance

[2] Personal information needing considerations: Information with concerns for occurrence of discrimination, prejudice and disadvantages in accordance with race, social status and past medical history, etc.

3.4. Decentralized Blockchain Ecosystem Structure

It is possible to guarantee the quality of data by using encoding technology without intervention by other people by having the user of LEMONCHAIN ecosystem to save the healthcare data records in appropriately approved blockchain. Service provider uploading data or consumer will engage in transaction. Private key will be provided to the user along with signature and time stamp to access data. It is possible to check all the records stored in the blockchain by using digital signature and complete individual's health information will be generated. It is possible to safety move data through digital signature and encoding technology, and only those with appropriately private key can access the corresponding data.

When adding data to EMR by using blockchain, log information on the corresponding event is saved, which enables monitoring of all transaction records whenever needed later on since such information cannot be altered. In addition, it is possible to use the latest version records and user can confirm who accessed the records and used data. Since blockchain-based LEMONCHAIN ecosystem has decentralized structure, anyone who is approved can freely participate in the ecosystem without concerns for data reliability and manipulation, etc.

3.5. Incentives for wellness

All activities for generation of health data in the LEMONCHAIN ecosystem will be compensated by granting of token to the users This compensation is made by means of LEMONCHAIN, which is a digital token with prescribed value. People who execute health service or healthier lifestyle are helpful in the advancement of ecosystem by substantially reducing the costs. Although the existing system provides efficiency in comparison to the cost in the format of benefits given for the use by the healthcare service provider, such benefit rarely was given to the individuals. However, in the blockchain-based LEMONCHAIN ecosystem, distributes such benefits to the users through blockchain by generating token, which can be used as exchangeable currency thereafter.

User can obtain token in accordance with the activities in accomplishing their goals at health clubs, participating in health education program or sports event, and complying with administration of medication or digital treatment well. LEMONCHAIN ecosystem provides compensation in the format of granting tokens for the values of the affirmative actions that user engages in. Once data generated through such affirmative health related actions enter LEMONCHAIN ecosystem through expansion of the aforementioned concept, the user can save the tokens in his/her wallet and use them at the time of the use of hospital or healthcare related services

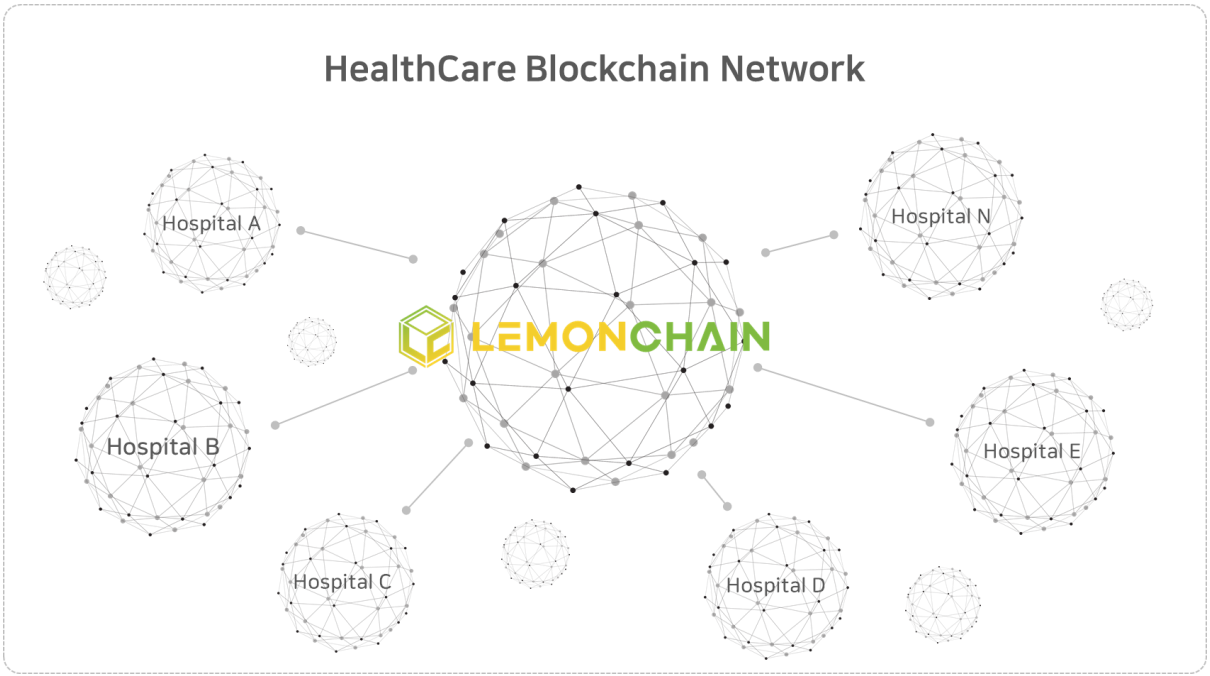
3.6. Healthcare Big data statistics & search service

Healthcare big data statistics & search service is a highly difficult analytic solution that easily converts the complexly dispersed healthcare and medical data held by users into meaningful information. Although the main data include healthcare data including medical data, sub-medical data with relatively lower importance are also included. Sub-medical data corresponds to name/age/gender/name of insurance company/ID code of medical department/family doctor/medical treatment cost/ID code for disease and illness, etc..

For example, In the case of medical institute, it is possible to support establishment of medical big data-based research ecosystem by markedly improve the resources required for medical data analysis at the time of clinical studies. Moreover, user can discern through the disclosed statistics that specific insurance company can provide

insurance services optimized for his/her circumstances in advance. It is therefore possible to realize easy access and linkage with healthcare big data for research among patient, medical scientist and corporation by markedly reducing enormous amount of time and efforts as well as costs necessary for healthcare service researches based on this solution.

3.7. HBN (HealthCare Blockchain Network)

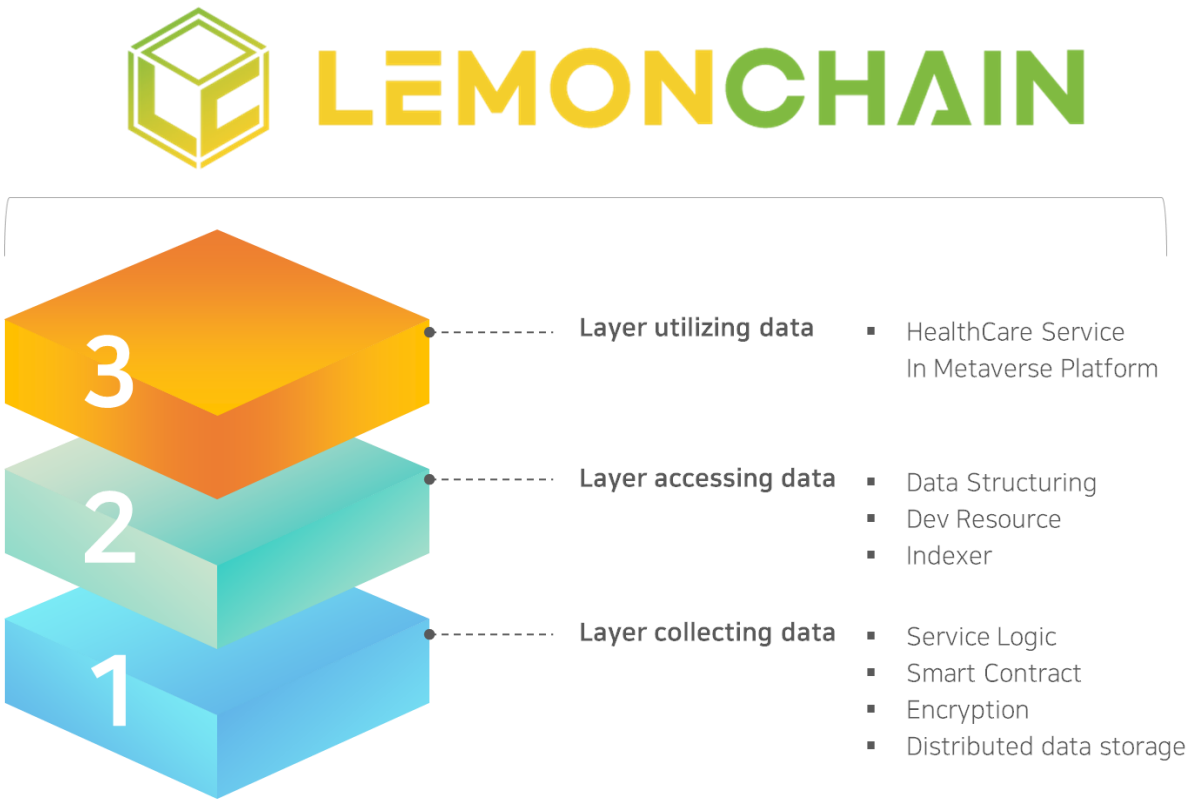


Size and standards of data that each medical institute holds differ and are stored individually and separately. Although the size of clinical records saved in electronic document formats is small at about megabyte level, size of medical images can range in the level of tens to hundreds of megabytes. In the case of genome data, the size will be at the level of gigabyte at the minimum although it will differ depending on the stage of data processing. Since there would be enormous burden to store all these data in the blockchain, data of patients are transmitted immediately to the LEMONCHAIN ecosystem by linking with individual medical institute by means of node. Each data is encoded by using private key before storing only the hash value of this data in the blockchain for connection to private node.

4. Technical details of LEMONCHAIN

4.1. LEMONCHAIN Ecosystem platform structure

LEMONCHAIN platform is composed through utilization of 3 layers, namely, data accumulation, data inquiry and data utilization.



4.1.1. 1st layer: Data accumulation

Data accumulation layer is the domain in which the core logic of LEMONCHAIN is executed and core data are stored. It is composed of smart contract, data storage (Blockchain, Inter Planetary File System – hereinafter, referred to as IPFS, Hybrid) and miscellaneous service logic. Since healthcare data generated and delivered through the ecosystem are generally delivered after having been encoded through LEMONCHAIN SDK, it is stored in dispersed data storage space that can safely protect data to the extent of preventing those other than the owner from viewing of the actual data contents.

In addition, data with large size or non-main data among the information necessary for service operation are stored separately in the dispersed data storage space. Through this, it is possible to provide convenience in service operation and resolve the issue of speed that blockchain has. For example, medical images, genome data and information with large size and data that are not essential even though they provide supplementary value to services such as sub-medical data can be stored in the dispersed data storage space.

4.1.2. 2nd layer: Data inquiry

Data inquiry layer is connected to data accumulation layer by using blockchain engine and provides data output interface for user's healthcare data management. Since data inquiry layer utilizes user's healthcare data and EMR with international standard specifications as services by reprocessing them, it is possible to sort necessary data by means of conditional searches.

User is provided with fees-paid service that utilizes only the functions of data inquiry layer and physicians can obtain benefits in accordance with efficient execution of clinical studies. Institute/corporation receives assistance in the maintenance or improvement of the insurance coverage of medical products through guaranteeing of the quality of data and information, and assistance in the innovative treatment product development.

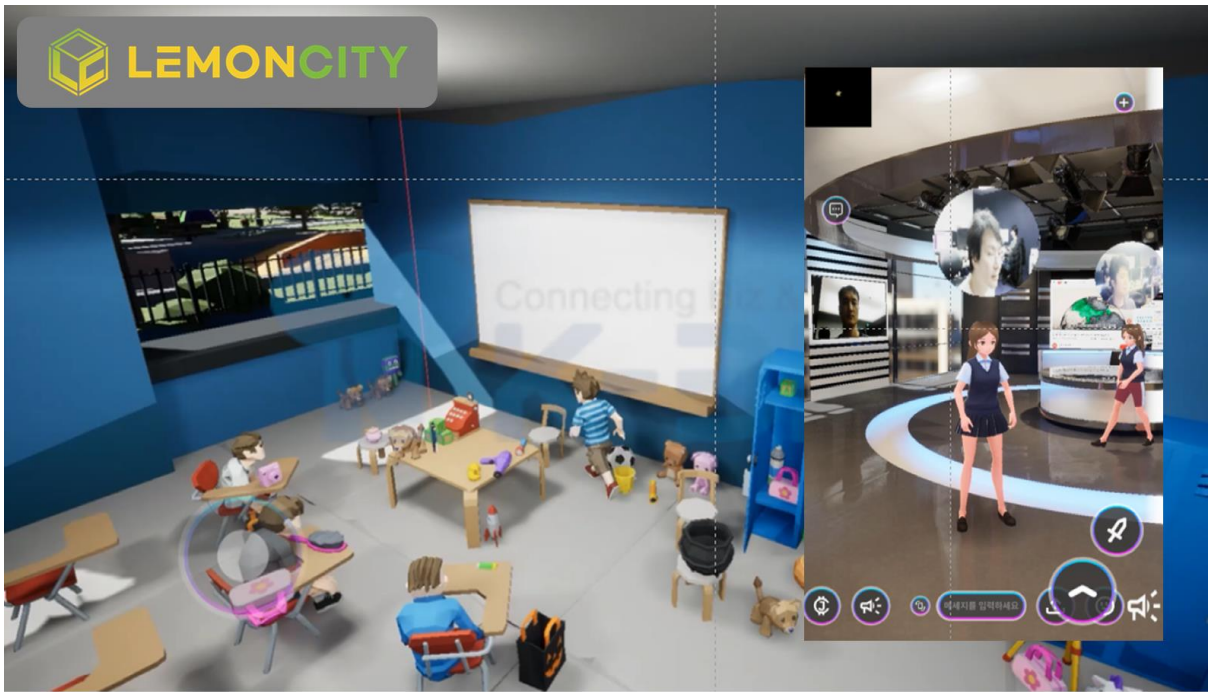
4.1.3. 3rd layer: Data utilization

All application services that manage and utilize healthcare data through the LEMONCHAIN ecosystem belong to this layer, which includes metaverse environment operated in various environments including mobile, app and web, etc. Metaverse environment enables easy access to healthcare data within the data utilization layer and we are planning to provide SDK to make metaverse related service development easier and faster.

If API and protocol to be disclosed with metaverse in the future is followed even if SDK is not used, it is possible to develop application service/program that can be linked with the LEMONCHAIN platform.

Optimal UI/UX that enables users to conveniently record their data are provided in the metaverse environment. Moreover, community can be composed to allow natural execution of activities such as sharing of information and obtaining emotional supports through communication with other users. Key service will be described in more detail in (5. LEMONCHAIN, core of metaverse).

5. LEMONCHAIN, Core of metaverse



[Source : K-biz]

There exists a small city with radius of about 5km referred to as 'LEMONCITY' in the world of the LEMONCHAIN-based metaverse, and user can own land in the LEMONCITY personally through purchasing of NFT and operate or trade healthcare related service store by constructing building on the land owned. Portion of products purchased from such store can be used immediately in the LEMONCITY as well as delivery to the real world. In addition, it is possible to acquire currency and items for travel to LEMONCITY by participating in event that are the same as real events.

User can obtain LEMONCHAIN (hereinafter, token) as compensation for the contributions made to LEMONCITY ecosystem. Moreover, user can receive financial benefits by participating in economic system within the LEMONCITY ecosystem in the formats such as the use of Service-To-Earn (S2E) Application of the real world, etc.

Majority of buildings existing in the LEMONCITY can be purchased directly by using token and inter-user trading is possible. At the time of purchasing the corresponding building, the user will obtain virtual commercial space additionally and can enter the corresponding building. Spaces in the building can be customized according to the preferences of the user including data insurance company, gene NFT exchange, healthcare data bank and healthcare lecture hall, etc., and income can be generated through selling of admission ticket for lecture seminars, etc.

5.1. Community system

Decentralized Autonomous Organization (DAO) related to healthcare exists within the LEMONCITY and it is referred to as a community. Community is a blockchain-based autonomous organization and rules are set through smart. If such rules are executed, tokens are distributed to the members of the corresponding community.
User will secure equity in the community in proportion to the token he/she owns and execute role of right to vote as well. As such voting rights equivalent to the quantity of token the user owns can be exercised at the time of making decisions on the operation direction of community, profit distribution structure and policies, etc. Although the community can execute requests such as simple gene analysis, it is possible to establish communities such as healthcare data auction house is diversified member are gathered.

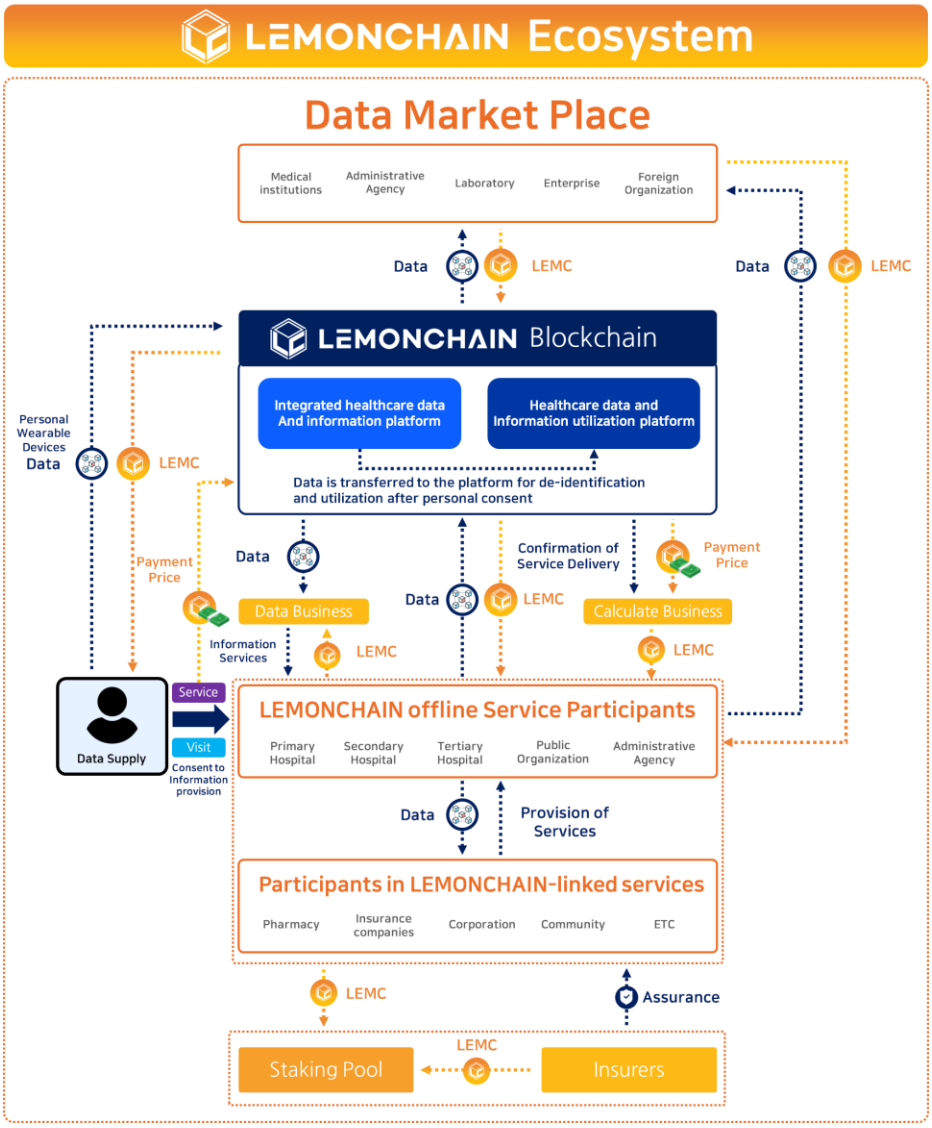
5.2. Healthcare and medical consultation center customized to individuals

LEMONCITY user can undergo free health consultation with physician at the consultation center within metaverse when he/she has health related inquiries. It is also possible to avail health consultation and management freely by employing physician he/she wants as physician in charge for prescribed period of time within the metaverse through utilization of fees-paid services.
Academic background, key medical treatment areas and location of hospital at which the medical staff participating in this consultation center works are introduced in detail, along with the full disclosure of the evaluations on the medical staffs by the patient and fellow medical staffs. Although LEMONCITY physicians are paid 5 tokens (LEMONCHAIN) for each health consultation case, they can be designated as physician in charge by many users if evaluation score by user and activity performances increases as result of satisfactory consultation provided. Moreover, promotion of the hospital at which the physician works can be executed.
The fees for the use of services provided by the physician in charge increases with higher activity performances and user's evaluation score. This system can be utilized as an alternative medical model for the regions in which the gap in medical services is severe and medical services cannot be received in timely manner by entering into strategic alliance with higher ranked general hospitals.

5.3. Gene NFT exchange

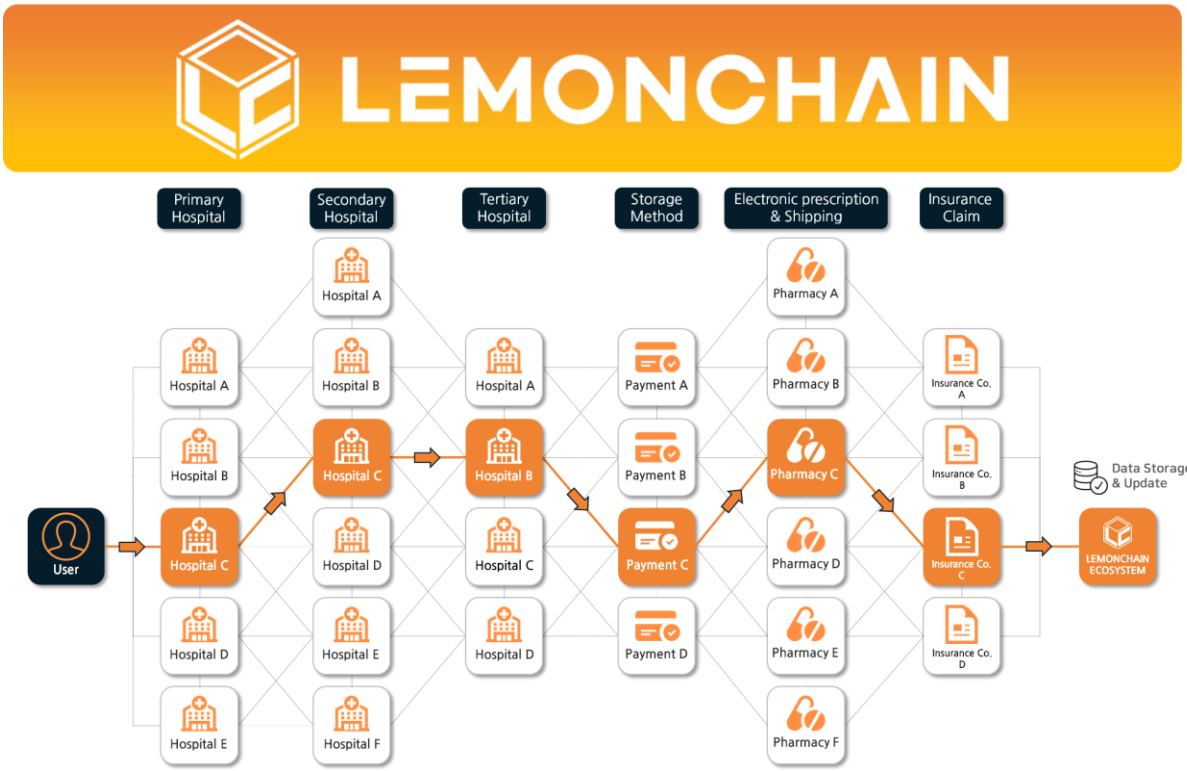
When user personally uploads his/her genome data through LEMONCITY, it is possible to store/preserve genome data based on blockchain. In addition, it is possible to secure mutual integrity of data by generating certification key of 'analysis institute', 'data owner' and 'certification institute' for the genome data generated at the time of medical examination, and provide NFT service to prevent forgery and falsification. User can compose NFT by including the entire DNA base sequence with each identifier, chromosome number, base pair location and gene types, etc. as the reference.
In addition, genome NFT image appropriate for the genetic characteristics of individual is generated automatically and the user will have the usufruct for generation, analysis, sharing and sales of his/her genome information as well as ownership right and self-determination right on his/her genome information.
Users can sell and purchase or participate in the auctioning of genome NFT in the exchange thereafter.

6. LEMONCHAIN, business flow



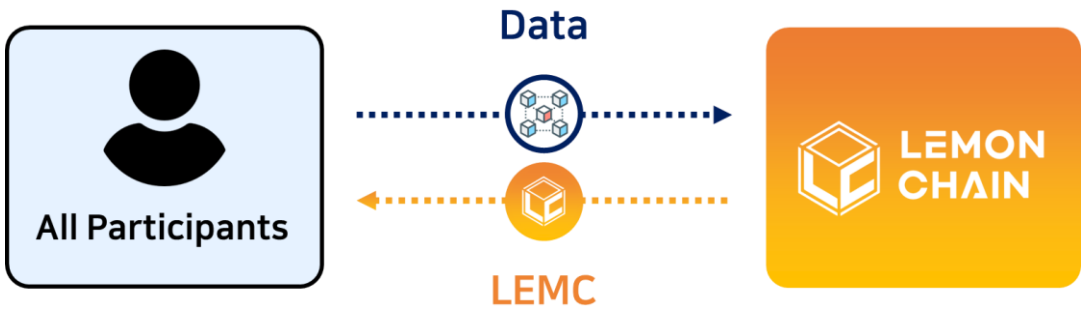
LEMONCHAIN blockchain is dualized with [platform for integration of healthcare data and information, and platform for utilization]. Individuals will collect the [healthcare data and information in the integrated platform] safely after having undergone consent for provision of personal information as the principal for the provision and management of healthcare data and information. Data that have undergone consent of individual for the utilization in the [healthcare data and information integration platform] are moved to the [healthcare data and information utilization platform] after having undergone information anonymization works. As such, it has the virtuous cycle structure in which the private companies and research institutes, and foreign institutes, etc. utilize anonymized healthcare data and information through [healthcare data and information utilization platform] and prescribed portion of the additional values and benefits generated through information utilization are provided to the information providers.

6.1. Provision of complete decentralized healthcare service



Healthcare data of user is transmitted to the service providers the user wants within the LEMONCHAIN ecosystem to enable the user to personally select the medical treatment or service procedures, and combination most appropriate for the purposes of the user can also be recommended. Through this process, the user can easily exchange data with service providers participating in the ecosystem and all the services executed are recorded in blockchain with automatic generation of smart contract for payment of charges. User can execute smart contract under diverse conditions including payment of additional incentives if the service providers satisfy specific conditions. In addition, the user can personally compose healthcare service in the format that is most appropriate for his/her purposes through utilization of diversified options.

6.2. Data upload



The most essential element for maintenance of LEMONCHAIN ecosystem is the healthcare data that all the participants are uploading.

There are diversified healthcare data for which incentives can be obtained by being uploaded in the LEMONCHAIN including personal health records (PHR), EMR, Electronic Health Records (EHR) and anonymized (De-Identification) medical data and clinical trial data, etc.

Incentives are composed of structure in which the compensation decreases if the time of uploading from the time of data generation is delayed more greatly in order to ensure that the reliability of data can be increased. In addition, issues related to the data reliability will be resolved by uploading the data in real time through connection with wearable device and online hub connection among business operators.

Incentives are paid from the Token Pool (8.2 LEMC token Pool) established with some of the reserve quantity of tokens and those generated through ecosystem fees, with the quantity of token to be paid determined according to the extent of contributions made towards LEMONCHAIN ecosystem.

6.3. Settlement of account

Process for settlement of account for the costs of services is necessary one contact for the healthcare service is entered into. At this time, subjects of the settlement of account is not limited only to the costs associated with the healthcare service but also include all processes associated with the monetary transaction between the supplier and consumer. Through this process, settlement of account for LEMC token to be issued and used within the LEMONCHAIN ecosystem will be provided along with the credit card and the existing means of settlement of account such as cash for the convenience of the user. Although the use of token is difficult, entry barrier for introduction of token in the actual use will be lowered through collaboration with the existing business operators of settlement of account services such as Naver Pay and Kakao Pay, etc. in order for the users to enjoy the values that LEMONCHAIN ecosystem is providing.

Although the preferences for legal currency and LEMC token differ depending on the participants of LEMONCHAIN ecosystem, there is a need for business operator for settlement of accounts to solve the problem of the difference in the time of entering into contract and he time of the settlement of account (6.8 Additional business operator). Any business operator with verified capability to exchange the legal currency and LEMC token in accordance with the given demand can participate as business operator for settlement of accounts.

6.4. Making payment

Payment that the healthcare service user made is given to the service providers through smart contract. Each providers can request remuneration for the portions of the contribution the provider made towards the overall healthcare services and payments will be made when it is confirmed that there is no problem in the services that he/she provided. If there is not occurrence in the services provided by such service providers, payment is made automatically through the smart contract and the providers will be paid in accordance with the proportion of legal currency/token that they chose in advance.

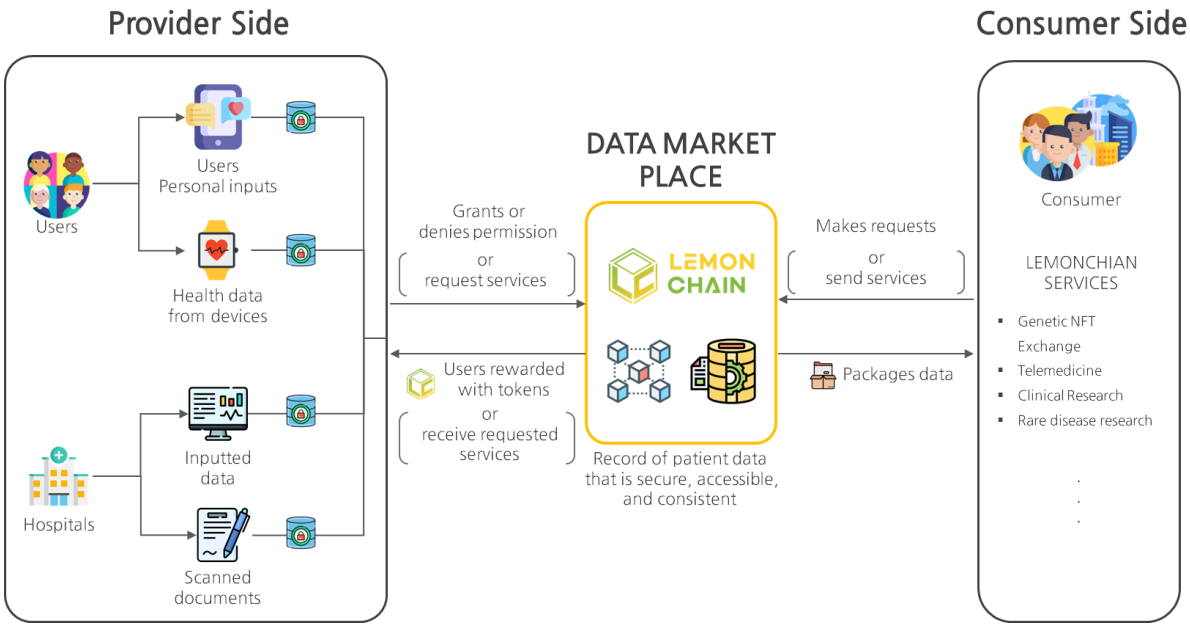
On the other hand, if problems occur in the services provided, payment will be postponed and will be kept in the LEMC Blockchain temporarily. This postpone payment will be made upon confirmation that there is no abnormality in the status of services that the user was provided with through the finally uploaded information. If problem occurs, compensation will be made through the guarantee deposit (6.6 Guarantee for quantity of healthcare services that can be provided according to staking) and insurance company (6.9 Additional business operator).

6.5. Data marketplace

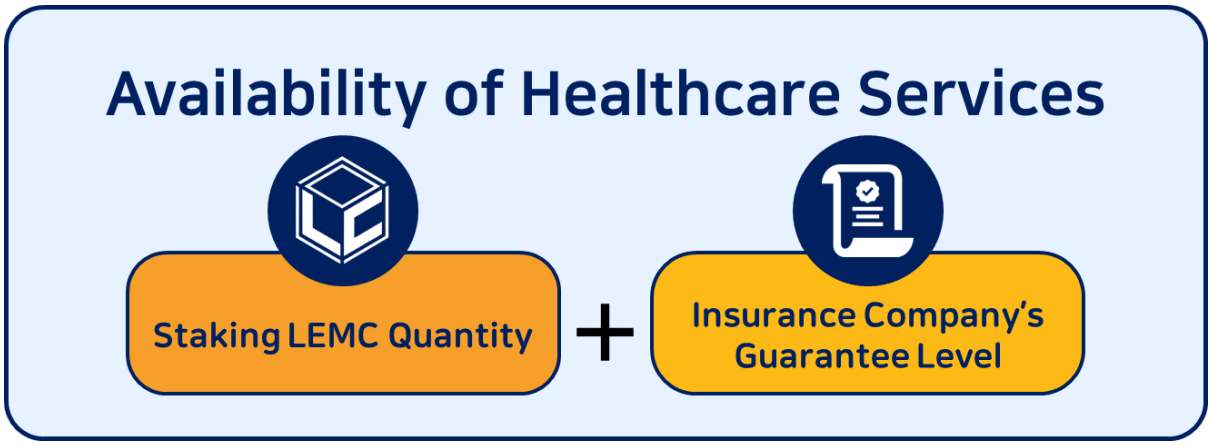
Data marketplace is a venue for purchasing and sales of healthcare data. The market is composed of interface from supplier's perspective and interface from consumer's perspective, with the supplier allowed to register the healthcare data in the market through blockchain, and approve or refuse the access and use of data by the consumer.

The consumer can search data supplier easily and can acquire the right to use data by providing prescribed quantity of LEMC token to the data supplier. Data supplier can set to which extent his/her data will be disclosed at the time of registration thereof and can exercise the rights on data through such setting.

Price of data will be set on the basis of the average market price as the reference and the right to make selection for the setting of the price that the supplier wants is guaranteed to enable the supplier to utilize the data marketplace without additional cumbersomeness.



6.6. Guarantee for quantity of healthcare services that can be provided according to staking



Service participant needs to stake LEMC token to guarantee the execution of his/her services. In order to enable collaboration-based healthcare service, it is essential for the associated participants to faithfully execute their respective duties and be responsible for the costs incurred when they failed to fulfill their roles or if problems occur. For this purpose, the participants will stake prescribed quantity of tokens as guaranty deposit in the LEMONCHAIN ecosystem for use as means of compensation in the event of occurrence of problems.

Token staked by each participant contains the significance of guarantee for the services provided and, in order to be granted with larger quantity of service contracts under the LEMONCHAIN ecosystem, token that corresponds to such quantity must be staked. Quantity of tokens that can be staked is computed based on the existing history of the participant and reasons for sincere execution of contact is provided through this.

If the participant wants to provide services in excess of the token staked, it is possible to provide guarantee for the contract through the use of insurance business operator.

6.7. Mediation of disputes

Although occurrence of disputes can be minimized by recording the entire processes of services rendered in the LEMC blockchain, there could be generation of diversified disputes that require mediate by a 3rd party in the process.

If disputes occur, LEMC steering committee will be composed by selecting a representative among the participants for each service domain for delegation of authority for dispute medication. The members of the steering committee will be selected from diversified groups including data supplier, consumer and healthcare service participants, etc. in order to represent the diversified participants of the LEMONCHAIN ecosystem.

6.8. Fees

At the time of the settlement of account and making payment, portion of the payment made is also paid as a fee for the payment of compensation for the operation of LEMONCHAIN ecosystem and to user. The sum of the

fess is at a level lower than the fees of the existing agencies for the settlement of account and will be set to ensure that greater value will be returned to the ecosystem participants through setting of such lower fees.

If each participant is paid with LEMC token, it would be possible to use the ecosystem at lower fees than that payable with legal currency. By offering incentive to the participants using token through this arrangement, use of LEMC token is encouraged.

6.9. Additional business operator

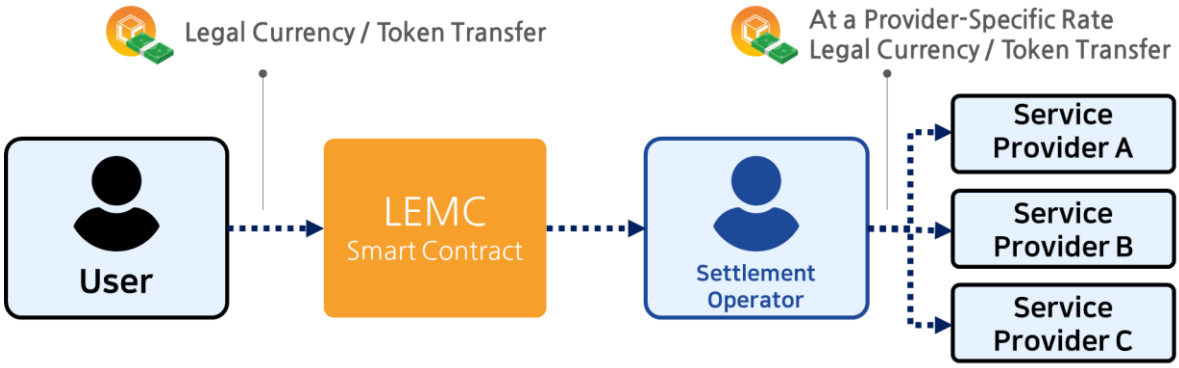
It is necessary for additional business operator other than the service providers to participate for harmonious operation of the LEMONCHAIN ecosystem. Additional business operator provides additional service to the participants that are difficult to be provided by the ecosystem. Additional business operators include information business operator, settlement of account business operator and insurance business operator, and it is forecasted that more diversified business operators will participate as the ecosystem progresses further.

6.9.1. Information business operator

Information business operator plays the role of generating values by processing raw healthcare data. Participants of LEMONCHAIN ecosystem receives information they need from the information business operator by paying prescribed quantity of token as remuneration for the information they use.

The information business operator will ensure that the ecosystem is operated harmoniously by providing information that can enhance the efficiency of participants and proposing optimal means that are appropriate for each of the services provided within the ecosystem. In addition, they will also assist harmonious operation of data market by refining the healthcare big data into data products that the data consumers want through organization and analysis thereof outside the ecosystem.

6.9.2. Settlement of account business operator



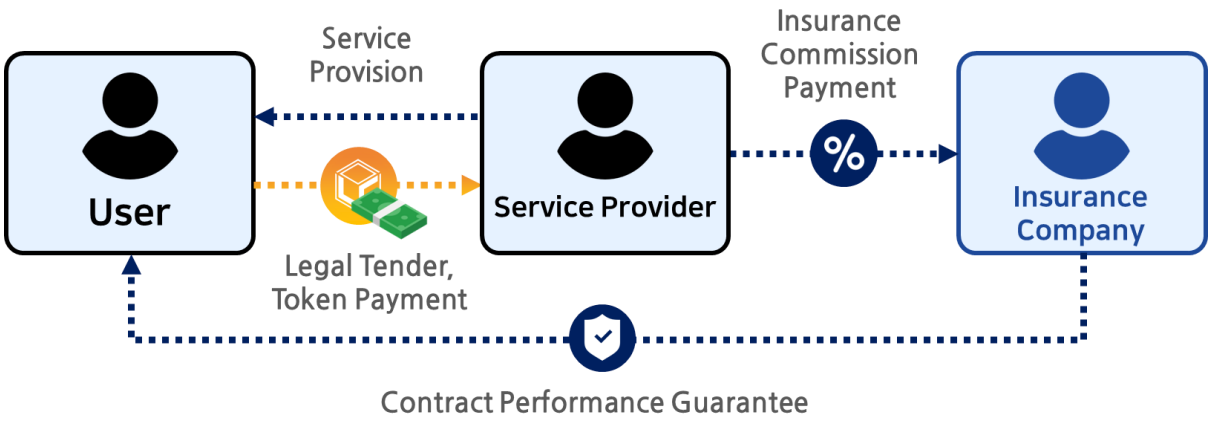
The settlement of account business operator is an additional business operator who provides flexibility to the settlement of account of LEMC by playing the role of converting legal currency to LEMC token or vice versa, or filling in the gap between the times of the settlement of account and actual payment in accordance with the request by the participants. If the format that user wants to use for payment and the format the participant wants for collection of payment differ, the user can make request to resolve such difference by selecting a

settlement of account business operator. For example, if user wants to use credit card and the service provider wants to be paid with LEMC token, the settlement of account business operator selected will receive payment for the settlement of account with credit card and then pay the service provider with token at the time of payment.

Conversion rate and fees thereof are decided by each settlement of account business operator and the participant can choose the settlement of account business operator based on these informaiton.

The settlement of account business operator will generate profit by collecting fees for the settlement of account and profit trading through utilization of the difference in the payment between the time of settlement of account and the actual time of payment. Given the characteristic that substantial time is required for the offline visit to medical institute, etc., there could be substantial difference between the time of the settlement of account and the actual time of payment, thereby generating profit model based on diversified financial techniques founded on such difference. It is anticipated that this will give birth to diversified business models in efficient settlement of account formats appropriate for the needs of the participants.

6.9.3. Insurance business operator



Insurance business operator is an additional business operator who enables the participants of LEMONCHAIN ecosystem to provide services in excess of the token staked to the participants by executing the role of guaranteeing the execution of the contract on behalf of the service providers. Each service provider can guarantee the execution of additional contracts through the use of insurance business operator in order to increase the number of services that the provider can handle simultaneously by paying prescribed fees to the insurance business operator as remuneration thereof.

Insurance business operator needs to make compensation on behalf of the service provider if the provider fails to fulfill its obligation under the service contract. For this purpose, the insurance business operator also needs to stake prescribed quantity of LEMC token. Insurance business operator can also enter into insurance contract in proportion of the quantity of token staked and can adjust the insurance premium/fees by computing the risks based on the past history of each service provider. The insurance business operator plays key role in enabling late comers in the provision of services to participate in the LEMONCHAIN ecosystem at low cost.

7. Future of LEMONCHAIN ecosystem

7.1. Employment of LECO format for the 'Healthcare data & service'

For the LEMONCHAIN ecosystem, format of system that combines healthcare data and services that are different from each other will be provided through utilization of the characteristics of blockchain similar to those of Money LEGO[3]. Through the synthesis of protocols of countless healthcare data & services with each other, new secondary and tertiary processed data or services are generated, which can be used by substantially larger number of users that those of the existing ones. Moreover, it will be manifested in the format that is more cost efficient with faster processing thereof.

7.2. Application of DeFi system

7.2.1. Automated Market Maker (AMM)

Similar to the Uniswab protocol, opposite trading is carried out under crisis situation in accordance with specific formula to lower the price fluctuation of LEMONCHAIN. Price mechanism is based on $x \times y = k$. As an example, if the value of 1,000 LEMONCHAIN's maintain the value of 1 million KRW, both are deposited and the quantity of LEMONCHAIN is adjusted to enable the value of the constant, k, is continuously maintained at 1 billion KRW.

7.2.2. Lending protocols: Healthcare data-based loan-deposit margin model

It is a collateralized loan service by utilizing countless assets utilized in the LEMONCHAIN ecosystem. For example, healthcare data, gene NFT or LEMONCHAIN, etc. that one owns can be used as collateral. Although the loan to value (LTV) ratio level will be aligned with the ecosystem environment, conversion will be made at about 60% of the values of the assets in general. If the value of the collateral falls, settlement of account will be proceeded for the loan by automatically selling the collateral by corresponding protocol.

7.2.3. Synthetic assets: Issuance of token that follows price of specific asset

Data marketplace evolves into platform for trading and investment of synthesized asset with stable token obtained by staking the LEMONCHAIN. Additional incentives other than staking compensation will be provided to the user in order to activate participation in staking and fluidity.

7.2.4. Service for trading of divided ownership of healthcare data NFT

Divided ownership will be issued with NFT and the collateral with designation of the quantity of division, price for each piece, sales period and profit ratio, etc. Trading is completed when the sales rate of the ownership pieces reach 100% and individual (piecewise) trading is possible as in the case of ordinary NFT products following the forwarding of divided ownership. It will enable multiple number of users to make divided purchases

[3] Money LEGO: It means that synthesis, combination and convergence is easy as if piling up LEGO blocks since all program codes that compose the DiFi are disclosed as open source.

and own the ownership of highly valued NFT by as much as the users want without the burden of having to pay large amount for the ownership of the whole NFT.

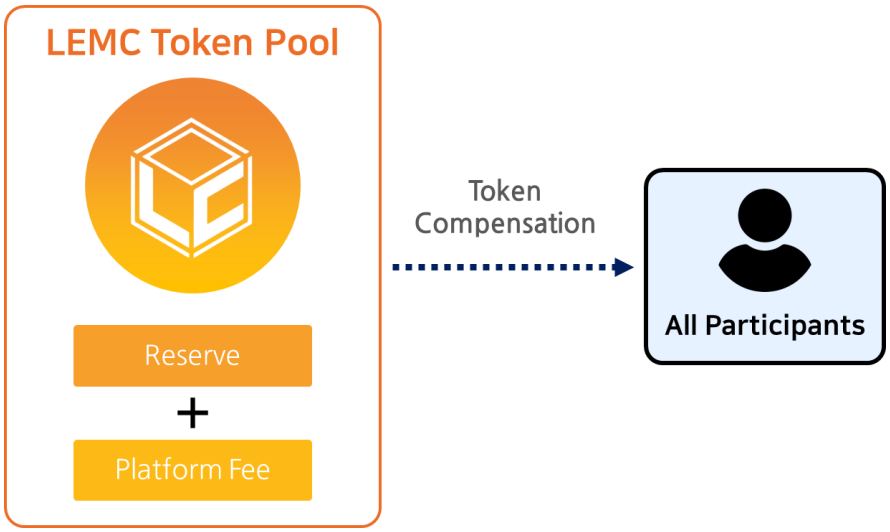
8. Token model

8.1. Overview of LEMC token

LEMC token is a medium for interaction among the participants of LEMONCHAIN ecosystem, and is used for various purposes including incentive for voluntary data input by participants, payment of fees for the use of data, charges for mediation of disputes, payment for provision of services and utilization as collateral to guarantee execution of contract, etc.

LEMC token is issued as Klaytn-based KIP-7 token and conversion into other protocol can be considered in accordance with the need to accomplish the road map set thereafter. In such case, LEMC token already issued will be converted into tokens based on the new protocol.

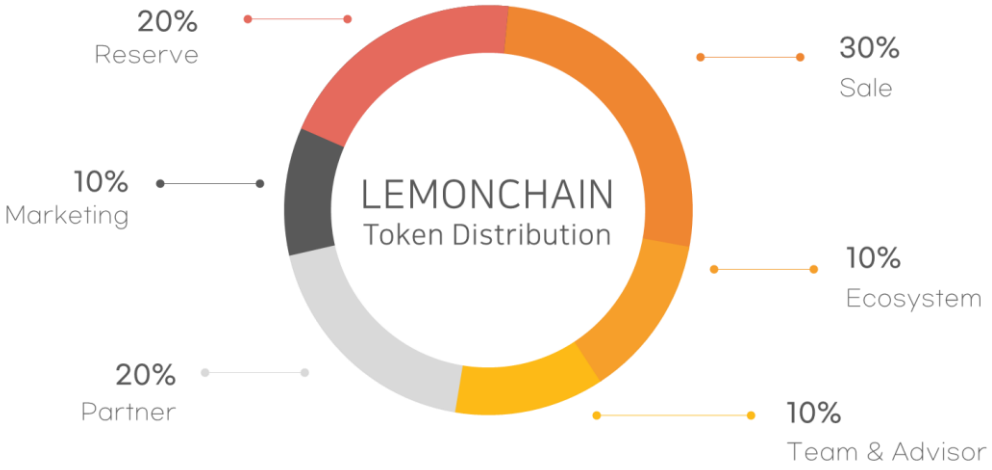
8.2. LEMC token Pool



All participants who made contributions towards LEMONCHAIN ecosystem will be given LEMC token as incentive through activities. Incentives are given from the LEMC token pool, which is established with portion of platform fees collected and portion of the reserve kept from the initially issued tokens.

Each participant makes contributions towards ecosystem by uploading healthcare data and incentives are distributed differentially in accordance with the value of the data provided. At this time, the value of the data is determined based on various factors including quality, characteristics and reliability, etc., and can be adjusted regularly.

8.3. Token Allocation



Publisher	LEMONCHAIN LTD.
Token Name (Symbol)	LEMONCHAIN (LEMC)
Token Platform	KIP-7 Token
Token Issuance	3,000,000,000 EA
Token Sale	30%

USE OF PROCEEDS

9. Road Map


LEMONCHAIN ROADMAP
Stage 01
Sirona
LEMC Ecosystem Alpha ver. Closed test
The LEMC testnet is a free-to-use blockchain that is designed for testing purposes.
It runs code that is the latest Alpha release version. LEMC users - such as exchanges, developers, and the regular community – can use the testnet to test in a production-like environment off the main blockchain, since the testnet has the same functionality, integration capabilities, and properties as the LEMC production environment.
Alliance Private Blockchain Node Connect
The key goal of this project was to create a secure hospital infrastructure and organization in order to ensure privacy and secrecy to all the hospital's patients without any delay.
Alliance Ecosystem DApp Launching
The DApp is a protocol for building decentralized applications (DApps) quickly on LEMC using Klaytn sources.
Depends on: Alliance Private Blockchain Node Connect
Stage 02
Aceso
LEMC Ecosystem Beta ver. Release & Metaverse Beta ver. Release
The beta version of LEMC Ecosystem is officially released and a metaverse is implemented. Metaverse Network is a healthcare service-enabled blockchain network for user-created metaverses and services.
Everyone can start their own metaverse for their people with the 3D world, NFTs, play-to-services & build communities to earn and takes community engagement to a new dimension on web3.0.
HBN (HealthCare Blockchain Network)
Set up HBN (HealthCare Blockchain Network) that enables LEMC to exchange medical data with partnership hospitals.
Confidential Smart Contracts
Integration into Confidential Smart Contracts; provides on-chain confidentiality of funds, actions, business practices.
Depends on: HBN(HealthCare Blockchain Network)
Stage 03
Lenus
Networking
A fully decentralized cryptocurrency needs a fully decentralized network layer, which is the part of the system that allows nodes to join the network and to send and receive transactions and blocks. To be fully decentralized, this will work in a peer-to-peer (P2P) way without relying on any central authority.
Consensus Incentives and Fees
The goal of designing an incentive scheme is to ensure that it is in each person's self-interest to behave in a way that makes the overall system function stably and reliably.
Smart Contract Integration
Enable using LEMC in smart-contract Blockchains [Klaytn and/or Ethereum]; Leads to countless use cases, including Defi
Stage 04
Urania
LEMC Ecosystem Main ver. Release & Metaverse Main ver. Release
The LEMC network to become a self-sustaining system. With the introduction of a voting and treasury system, network participants will be able to use their stake and voting rights to influence the future development of the network. You can experience all of this in the metaverse world.
DAO On-chain Governance
A DAO smart contract to replace current LEMC Board model; opens LEMC Project and Endowment to community governance.
Depends on: Smart Contract Integration
Strengthen Blockchain Security
Decentralized security against mining attacks; enhances blockchain security for Exchanges, pools, large transactors
Stage 05
Sekhmet
LEMC for Finance
List LEMC as an asset on premier lending Platforms & bootstrap liquidity;
Enable investors/miners/merchants better plan and utilize LEMC income.
Network Upgrades
Optimizing the main chain network's processing capability to improve speed, safety, and stability of LEMC systems.
Depends on: Networking
LEMC Ecosystem Global Expansion
LEMC Ecosystem go international through joint ventures, partnerships with medical centers in their target locale. International patients might no longer have to face the inconveniences and costs of travel to get the expert medical advice they need.

10. Timeline

2022 1Q
- Global Crypto-exchange listing
- Alliance Ecosystem 1st DApp launch

2022 2Q
- Domestic Crypto-exchange listing
- Hospital Healthcare Blockchain Network kick-off
- Customized Prescription Menu Recommendation Service launch
- Patent registration for drug delivery service using electronic prescription service
- Implement integrated hospital reservation service architecture
- Development of telemedicine-based technology

2022 3Q
- Domestic Crypto-exchange listing
- Healthcare NFT Whitepaper launch

2022 4Q
- Global Crypto-exchange listing
- Alliance ecosystem 2nd DApp launch
- Healthcare Device Solution launch
- Lemoncity Metaverse Prototype launch

2023 1Q
- Establish blockchain cloud storage
- Alliance ecosystem 3rd DApp launch

2023 2Q
- HL7 FHIR & other medical record standards support and API/SDK disclosure
- Global PHR DApp development
- Healthcare NFT M2E Service launch

2023 3Q
- 3rd Party Network support
- Global AI healthcare solution development
- Disclosure of Healthcare NFT Offline Partner
- Hospital Healthcare Blockchain Network launch

2023 4Q
- Global pharmaceuticals, clinical trial centers PoC
- Global PHR DApp alpha open
- AI-based 100 Q&A Service launch

2024 1Q

- AI healthcare solution development
- Global PHR DApp 2nd Advanced launch
- Global healthcare data integration platform development
- Metaverse platform alpha open
- Disclosure of Healthcare NFT Governance DAO System (Community)

2024 2Q

- AI healthcare solution global launch
- Global hospital platform integration solution development
- Digital Therapy (DTX) Service Connectivity Platform launch
- Metaverse platform beta open: metaverse core (data exchange) support

2024 3Q

- Global healthcare data integration platform launch
- Healthcare Big Data Statistics & Search Services launch
- Metaverse platform development

2024 4Q

- Global hospital platform integration solution launch
- Healthcare Data Marketplace launch
- Gene NFT Exchange launch
- Metaverse platform official version released
- Metaverse Wallet Android / iOS App launch
- Pet Cloud Infrastructure Platform Interworking

11. Team & Advisors

Team

Jaewon Shin
CO-FOUNDER & CEO

- AIMMED CEO
- Mobile Doctor CEO
- MBC Medical Reporter
- Seoul National University Hospital Family Medicine Specialist
- Seoul National University College of Medicine Bachelor's degree

Kiuk Kwon
CO-FOUNDER & CEO

- Lemon Healthcare Co.,Ltd CMO
- Oracle Korea Marketing Manager
- Oracle APAC Financing Senior Manager
- Oracle Korea Strategic Division Manager
- Business administration at Kyungpook National University Master's degree

Jeongseok Oh
CSO

- Business Administration, Seoul National University Professor
- Stanford University Graduate School Management Science & Engineering Doctor's degree
- Stanford University Graduate School Management Science & Engineering Master's degree

Seongjun Kim
CTO

- BITFLOW CEO
- Green Stage Lab Researcher
- LG CNS Senior Researcher
- Department of Computer Engineering at Yonsei University Master's degree

Songmin Kim
CTO

- iDataBank Global President
- LUXROBO GLOBAL General Manager
- Tmax CEO
- SK telecom Director o Convergence Technology
- Intel USA HQ
- MIT Computer Science Doctor's degree

Advisors: Medical & Digital Healthcare

Hyenuk Han
Advisor

- Professor of Cha Medicine
- Master of Engineering, Graduate School of Seoul
- National University
- Master of Medicine and Doctor of Medicine, Graduate School of Medicine, University of Tea Medicine

Jongyeop Kim
Advisor

- Associate Professor of Otorhinolaryngology at Konyang University Hospital
- Director of Information School of Konyang University Medical School
- Public Relations Director of the Digital Health Association of Korea
- Specialist in Healthcare Big Data Review
- Korea Health Information Service's Health and Medical Data Review Specialist

Jeonggyun Kim
Advisor

- Director of Namyangju Hyundai Asan Internal Medicine Hospital
- Director of Internal Medicine at Hyundai Asan Hospital
- A director of the Korean Medical Association
- Clinical Professor of Oncology at Asan Medical Center
- Doctor of Medicine at Kyungpook National University

Jaehyeong Jo
Advisor

- Director of ICT Medical Convergence Center at Seoul St. Mary's Hospital
- Information Director of the Seoul Medical Association
- Director of the Government Committee of the Korean Diabetes Association
- an executive secretary of the Research Committee of the Endocrinology Society

Advisors: AI & IT

Gitae Han
Advisor

- President of the Korea Hospital Information Association
- Head of medical information team at Konkuk University Hospital
- Policy Division, Smart Medical Security Forum
- My Healthway Infrastructure Subcommittee
- Member of the Electronic Medical Record Certification Committee

Minho Lee
Advisor

- Director of Artificial Intelligence Department, Kyungpook National University Graduate School
- Director of the Institute of Artificial Intelligence at Kyungpook National University
- Professor of Electronic Engineering at Kyungpook National University

Seeul Kim
Advisor

- Associate Professor of Content Management at Soongsil University Graduate School of Business
- Korea Creative Content Agency Evaluation Commissioner
- President of the Society for Content Management
- Permanent Director of the Big Data Society of Korea

Jihun Chung
Advisor

- Naver Connect Foundation SW Education Advisor
- Director of Kyung Hee Cyber University's Institute for Future Higher Education
- Professor of IT Design Convergence at Kyung Hee Cyber University
- Books such as "Smart IT, Smart Revolution", "The Future My Child Will Meet", etc

Jaechan Shin
Advisor

- CEO of Life Festa
- Co-representative of Inos Park
- Producer of JCE Mobile Business Division
- JCE Mobile Convergence Development Team Leader
- FORSBRO GAME PUBLISHING Business

Advisors: Legal & Accounting

Myeonghwan Park

Advisor

- A lawyer representing Vision, a law firm
- Korea Exchange KOSDAQ Market Corporate Review Board
- an adjunct professor at Yonsei University's Graduate School of Law
- Secretary for Public Communication, Senior Presidential Office for Social Integration

Taeeon Ku

Advisor

- Research Consultant on the Development of Artificial Intelligence Self-driving Car in Response to the Unstructured Driving Environment of the Ministry of Science and ICT
- Member of the Special Expert Committee on Artificial Intelligence-IP of the National Intellectual Property Committee

Changu Choi

Advisor

- DB-stars Accounting Advisor, Korea Data Industry Promotion Agency
- Samsung Electronics C Lab, Tax Accounting Education Instructor for EBS Education Broadcasting
- A member of the selection committee for social welfare facilities in Seoul Metropolitan

12. Miscellaneous (legal issues to be notified, etc.)

Please read and make reference to the following notices prior to participation in token trading:

This notice is applicable to all those reading this white paper and be noted that the contents of this notice can be modified or updated. If you are not sure about your decision making in relation to the LEMONCHAIN project, it is recommended that you seek the advices of other specialists in the areas of law, finance and taxation, etc. Information provided in this white paper and our website are only for the purpose of making reference and are not advices related to the purchase of 'LEMONCHAIN'. In addition, all transactions including purchasing and sales of 'LEMONCHAIN' and decision making thereof must be made under the full responsibility of each interested party.

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