XENSOR Project

IoT network for automation of machinery and
fixed asset management

xensor

Contents

XENSOR Project

XENSOR
Project

1 Abstract

The advent of the fourth industrial revolution amidst novel innovations and technology induced revolutionary changes in everyday life. In particular, technology behind internet of things (IoT) began to receive much attention in constructing smart cities for its potential to solve problems concerning superannuated cities, traffic, energy deficiency, and crime. As both developed and developing nations competed to promulgate "city revolution" by devising smart cities, the importance of IoT garnered even more importance.

However, many hurdles, such as high investment costs and the dangers of data hacking, impeded the rapid commercialization of IoT. In order to manage entire cities and assets, communication networks requiring the manual installation of numerous gateways had to be implemented, and the costs of server construction and maintenance amounted to considerable burden. As a result, insufficient funding of the communication networks led to holes in security that increased the vulnerability to hacking.

Xensor, a business that previously developed and manufactured IoT sensor hardware, tackled the challenge to provide the IoT infrastructure required to construct smart cities. In doing so, Xensor decided to adapt blockchain technology and cryptocurrency ecology to solve the two ever-looming problems of IoTs: frail security, and high investment as well as maintenance costs. Xensor project has elevated the efficiency of data storage and transactions by automating specific points of data management, and has simultaneously lowered the cost of constructing IoT communication networks. In addition, Xensor plans to apply an incentive policy to its hardware clients by tokenizing data and providing monetary value to the data provided. These aspects play important roles in the structure of the Xensor ecology.

All in all, Xensor project has taken the challenge to integrate IoT, one of the main components of the fourth revolution, and blockchain to help construct efficient and effective smart cities.

2 Project Background

2.1 Smart City Outline

The fourth revolution has imbued our lives with diverse revolutionary technologies. Among the various innovations, smart cities based on IoT technology has received much attention as the solution to problems that traditional cities experienced. A smart city refers to a city in which its facilities and buildings have been applied with information and communications technology (ICT), including IoT, to provide effective services to its residents. The concept of smart cities is expanding throughout the world as the infrastructure and service that can solve problems concerning superannuated cities, traffic, energy deficiency, and crime.

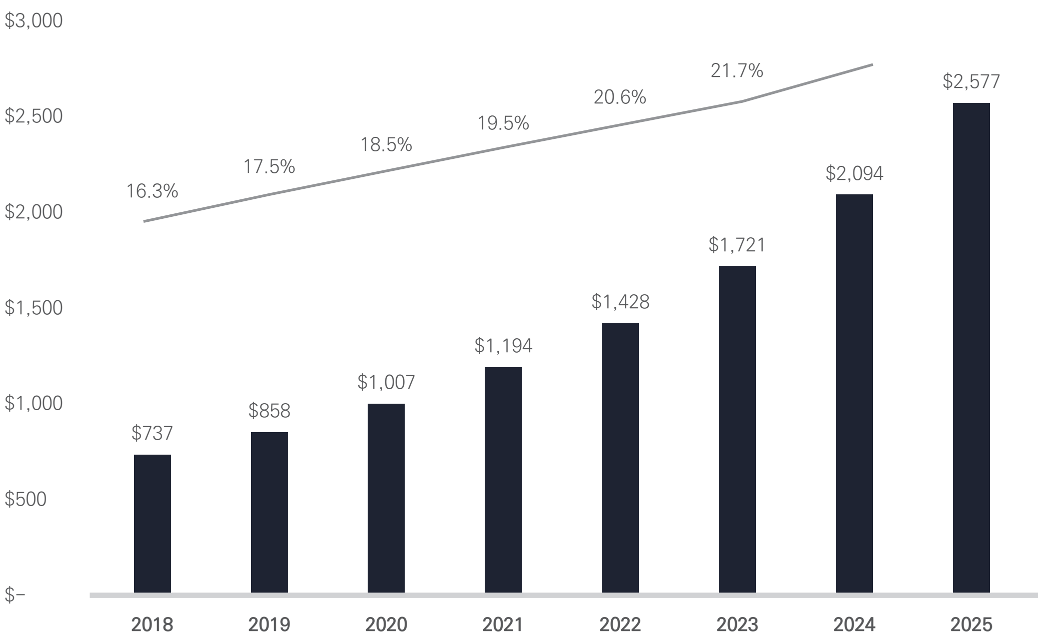
As an amalgam of multiple revolutionary technologies and city infrastructures, a smart city provides features that can be classified into the following three categories: infrastructure, data, and service. The “infrastructure” category begins the construction of ICT-based businesses, and includes elements concerning the city, ICT, and spatial information. The “data” category processes the information gathered by the infrastructure, and expands the network both vertically and horizontally, encompassing both IoT and data-sharing. Finally, it is the job of the “service” category to analyze the data and produce algorithms to better the lives of the residents and achieve “city revolution.” Among these elements, the technology behind IoTs, which connects devices and infrastructures within the city and gathers data from various sensors, takes the largest share of the pie as its market size is the greatest and as it requires the most investment.

Recently, both develop and developing countries are competing with each other to promote their own version of a smart city that serves as the model of city revolution. By expanding city infrastructure that uses state-of-the-art technologies, they all aim to create smart cities that simultaneously improve the quality of life and reflect characteristics of the country, city, and culture.

[Fig 1] Concept of Smart City Service

2.2 Smart City Market

[Fig 2] Global Smart City Market(US$bn), 2018 – 2025

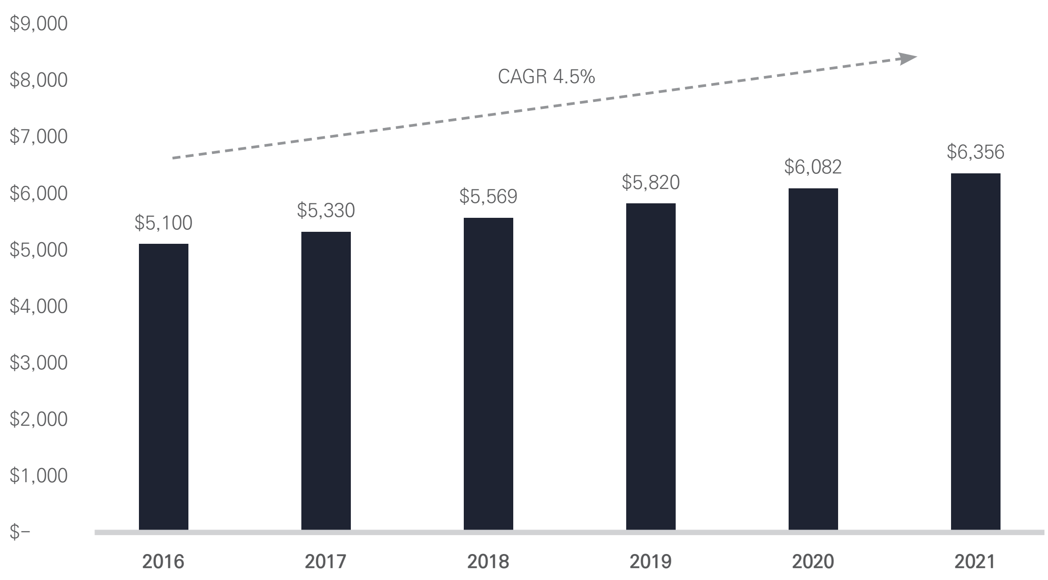


Source: "Smart Cities Market Analysis & Segment Forecasts to 2025", Grand View Research, 2018

The global smart city-related market is expected to reach USD 1.4 trillion by 2020. Currently showing annual average growth rate of 10~19%, the market is showing particularly rapid growth in the Asia Pacific region. Asia is expected to increase its share of the global city market from 28.6% in 2016 to 33.9% by 2025.

Smart factories and smart buildings that constitute a smart city are heavily influenced by IoT sensors, which enable the monitoring of traffic, energy, living, welfare, and water management systems. Consequently, the global sensor market, where Xensor's expertise lies, is expected to show noteworthy growth from USD 5.1 Billion in 2016 to USD 6.3 Billion in 2021. Over 1 billion new sensors are released every year, and average annual increase rate of total sensor production surpasses 50%.

[Fig 3] Global Sensor Market Size(US$Mn). 2016 – 2021



Source: Markets and Markets

2.3 Problems

IoT technology, which serves as the backbone of a smart city, comes with considerable cost and dangers of security. A smart city needs to efficiently store, utilize, and share data resulting from hyperconnected services, platforms, networks, and devices. Therefore, significant investment on gargantuan cloud services that manage sensors and data is required, and even after the construction of the infrastructure, continued flow of capital is necessary for the maintenance of the sensor hardware and servers.

Security is of paramount importance in IoTs that store data, monitor, and govern smart cities. In fact, the nature of IoT networks poses a grave security risk: a compromise of a single device may result in the hacking of the entire communication network, rendering substantial damages. However, because of the high investment costs of IoT solutions, many users have resorted to cheaper devices characterized by substandard security.

Moreover, the dissemination of cheaper devices undermine the credibility of the collected data because of their vulnerability to data hacking. Establishing the veracity of the data is crucial to the function of IoTs as the collected data is used to produce algorithms that provide the very services. The production of algorithm itself requires high level of difficulty, expertise, and technology, and thus comes at a great cost. If the credibility of the data is undermined, the algorithm also becomes futile, adding to the damages suffered by the investors.

3 Xensor Project

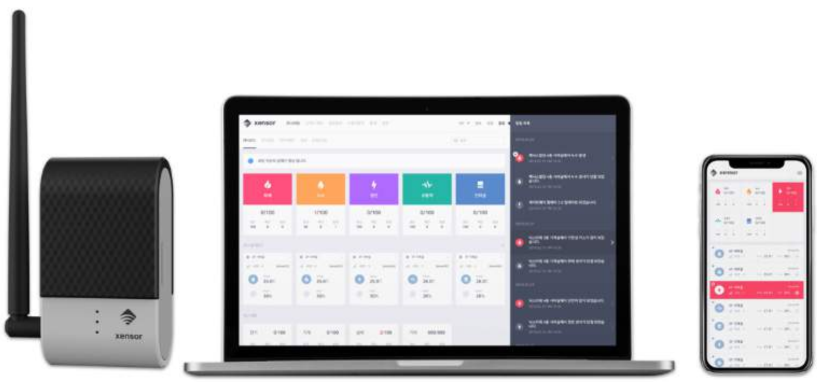
3.1 Project Description

Xensor, a business that previously developed and manufactured IoT sensor hardware, tackled the challenge to provide the IoT infrastructure required to construct smart cities. Xensor project has improved the efficiency of data storage and transactions by automating specific aspects of data management, thus lowering the cost of constructing IoT communication networks. Xensor has also integrated blockchain technology in device networks to ensure the credibility of the data, and plans to implement an incentive policy to its hardware clients.

Blockchain technology is ideal in supporting data transmission, automated services, monitoring, and mutual sharing services among devices within IoT networks. Although some drawbacks hamper the processing time and scalability of blockchain technology, the shortcomings can be compensated by utilizing IoT-specific main-nets and exploring ever-developing innovations.

Xensor will develop its project in the following order: asset surveillance, asset control, communication networks, and data market. Since Xensor has developed and commercialized sensor devices, the two stages of asset surveillance and asset control are already obtaining good results. Currently, Xensor is in the process of creating scalable IoT communication networks that can easily be adapted in various fields.

[Fig 4] Xensor device launch product



1) Asset Surveillance – Monitoring Farmland, Factory, and Buildings

Traditionally, various equipment were necessary to safely monitor a building 24 hours a day, requiring many maintenance personnel to make rounds of inspection and tend the equipment. However, hiring a considerable number of employees for every building is inefficient in terms of both time and cost. Such a feat can easily be replaceable by automated sensors.

A large building with total floor area of 26,000㎡ requires approximately 200 sensors. Connecting all these sensors with wired cables is both physically and financially cumbersome, and even with conventional wireless sensors, the fee per circuit is still costly due the shortcomings of IoTs.

Xensor provides the solution by applying low power wide area (LPWA) technology to connect sensors that are as far as 15km from the gateway. Even with a vast number of walls, a building with total floor areas of 26,000㎡ and 66,000㎡ requires only one and three gateway(s), respectively, to construct communication networks that span the entire area. With Xensor, only about five maintenance personnel is required to cover a total floor area of 26,000㎡.

LPWA technology is commonly used in the area of IoT to conduct remote surveillance and monitoring by sensors that relay low-capacity data at slower rates. Previously, technology such as Bluetooth and Zigbee were used in IoT connections, but these were limited to an area with a radius of only 30 meters. LPWA made a breakthrough in IoT technology by allowing transmission of data over dozens of kilometers, consuming less electricity, and conserving battery life over many years.

Currently, Xensor is providing its asset surveillance service to many large-scale buildings in Seoul, Incheon, Vietnam, and Indonesia.

[Fig 5] Xensor Solution – Asset Surveillance

2) Asset Control – Automation of Farmland and Factory Facilities

Farms that are immense in size, as those in California, require helicopters to spread agricultural pesticides. In order to reduce the inefficiency that results from using expensive helicopters, a novel method of watering the crops by installing equipment in sectors of the farmland was developed. Unfortunately, the innovation could not distinguish areas that were well watered from those that were dry, and the produce worsened.

Such a problem can be easily solved by using sensors that monitor the humidity of the land and IoT technology that controls water from the sprinklers. However, it would be very inefficient to use conventional IoT technology such as Wifi and Bluetooth to cover the vast area of farmland.

Xensor provides the solution with its miniaturized gateways that can connect sensors within a 15km radius. Xensor's products can thus create automated "smart farms," and even smart factories using the same technology in appropriate positions.

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Project

[Fig 6] Xensor Solution – Environmental Control

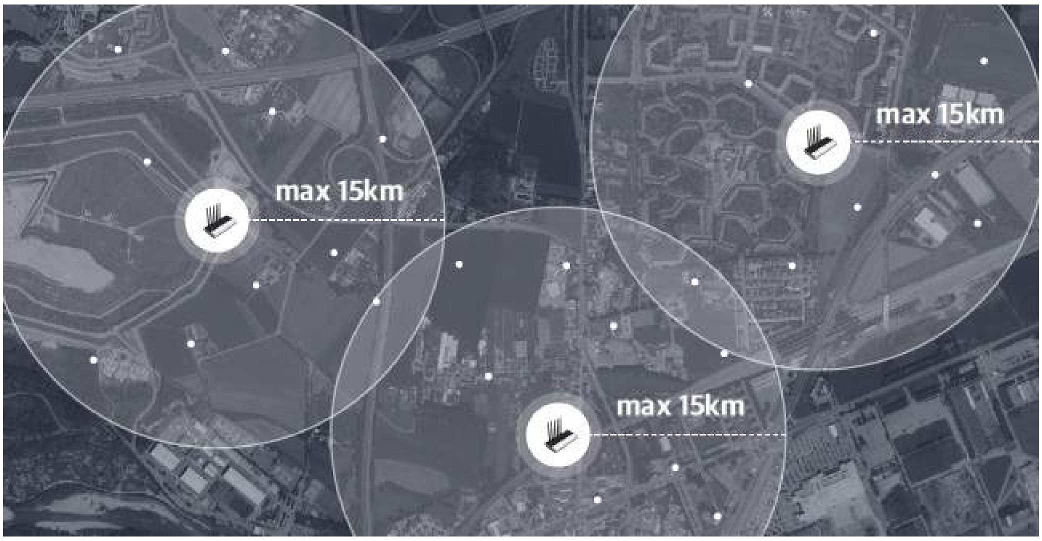
3) Communication Network

Just dozens to hundreds of Xensor gateways, which act as the backbone of the infrastructure of smart cities, can establish IoT communication networks throughout an entire city at a low cost. Currently, Xensor provides asset surveillance and control services with its sensors and communication technology. By advancing into the third stage, the communication network, Xensor will be able to provide more diverse services using the scalability of IoT devices and networks.

Many countries in South-East Asia, which are home to some of the most famous tourist spots, are vulnerable to calamities and safety accidents due to the lack of city infrastructure. For instance, drainage systems become easily overburdened during rainy season, compromising roads and thus tourist services. IoT solutions may provide a solution to this predicament, but the substantial cost deters the city from installing the necessary equipment.

Xensor, however, can be an option for these cities in developing countries of South-East Asia, as it can set up communication networks at a lower installation cost and an even lower maintenance fee.

[Fig 7] Xensor Solution – Communication Networks



4) Data Market

Xensor sensors can currently detect fire, leaks, power failures, and malfunction, and a new sensors with functions detecting air quality and floating population are under development. The aggregated data from these sensors may contain danger-related information of a particular area, providing valuable information with monetary value.

For example, black boxes in automobiles are usually used to assess car accidents, but car insurance companies provide discounts if the car owner chooses to install a black box in his or her car. Similarly, Xensor can provide data that predicts danger and accelerates emergency response, which may also lead to financial incentives after the installment of Xensor devices.

Xensor gateways can be applied in all services of a smart city once it is installed. In particular, if autonomous cars are commercialized, Xensor can be used to calculate the risk of car accidents and predict traffic. Xensor can collect data from any location, and it is not limited to buildings, farmlands, and factories. Such data can be of fiscal value to insurance companies, investment banks, governmental institutions, consulting firms, and credit card companies.

One of the goals of Xensor is to provide a decentralized data market platform based on blockchain and cryptocurrency technology. Data purchasers from anywhere in the world may procure data uploaded in the data market with cryptocurrency, and data sellers may sell the collected data, creating a healthy market with continuous flow of demand and supply.

XENSOR
Project

3.2 Business Model

The business model of Xensor is composed of three elements. Firstly, Xensor provides asset automation services using its sensors. Secondly, Xensor creates IoT communication networks using its gateways. Thirdly, Xensor establishes a decentralized data market where the data collected from the previous two items may be traded.

The three elements of Xensor's business model operate the business under an organic relationship that begins with the automation service enabled by Xensor sensors. They are backed by sensor, terminal, and network technology, which are applicable in both immobile and mobile assets, and in both miniature and large assets.

Many sensors detect various changes, including temperature, vibration, movement, and weight. The data collected by these sensors are stored within the interior and then integrated at the terminal. The terminal exists in various forms in a smart city, be it an automobile, air conditioner, or a heavy machinery. The integrated data can be shared and analyzed through the decentralized data market to provide various services for the assets of the smart city.

[Fig 8] Xensor Business Model

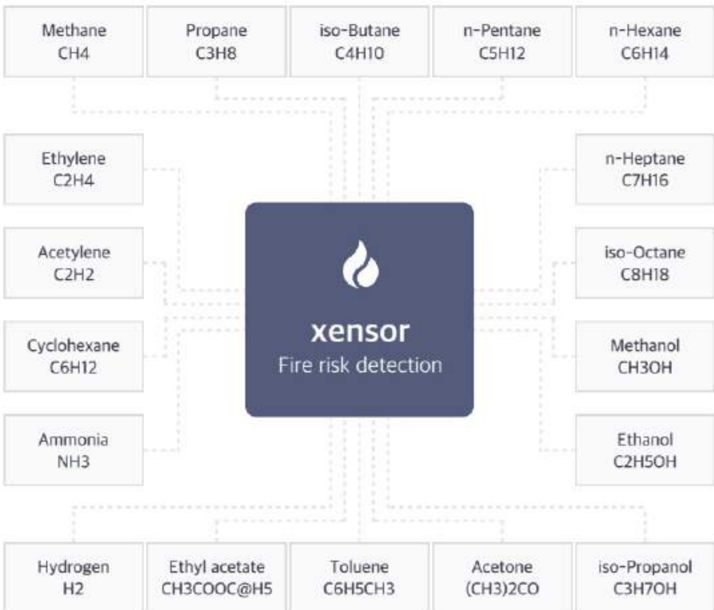
1) Asset Automat

Xensor devices for the smart city is composed of multiple sensors. Internal machinery includes temperature, humidity, and gyro sensors that detect earthquakes and misplacement. External sensors detect fire, leak, power shortage, and malfunction. The fire sensor developed by Xensor deserves a special mention as it is different from other commercial fire sensors.

One of the main reasons for fire in a building is that sprinklers are turned off in a particular area that is undergoing interior redesign or partial reconstruction. Sprinklers need to be disconnected lest a sparkle due to welding may set off the sprinklers of the entire building. The workers have to take the risk of working amidst inflammable gas such as toluene produced from paint or paint thinners while the sprinklers are turned off.

Fire sensors developed by Xensor, however, can detect 14 types of flammable gases unlike conventional fire sensors that can only detect carbon monoxide. By continuing to add powerful and distinctive features in its sensors, Xensor strives to produce even more specialized data.

[Fig 9] **Capacity of a Fire-detecting Xensor Sensor**



2) IoT Network Based on Gateways

Xensor sensors can perform both asset surveillance and asset control by using their sensed data to operate a controller. An IoT network is required for this task, but devising a network using conventional technology such as WiFi and Bluetooth are very inefficient.

Xensor's miniaturized gateway can provide wireless communication around a 15km radius, enabling the construction of highly efficient IoT networks. Despite its minimized size, Xensor gateway can control an entire farm, and solve environmental tasks such as controlling city lights and car parking.

Moreover, installment of mere hundreds of Xensor gateways can create a communication network that covers an entire city. With the integration of sensors and communication technology, the network can provide diverse services for the city, including but not limited to environment surveillance and control. The global efforts to design smart cities is a great opportunity for Xensor to provide communication infrastructure to developing countries in South-East Asia

The second-generation Xensor devices currently under development have achieved enough miniaturization that they can function even within IoT networks of wire services. In other words, the new Xensor devices become fully functional just after attaching onto point-of-sale (POS) devices in franchise and retail stores. Xensor has partnered with Nuvent, a rising commerce company in Korea, to install sensors in the head office buildings of ten franchise firms and 3,400 retail stores. By doing so, Xensor will be able to collect diverse data that will be conducive to the creation of a decentralized data market.

3) Decentralized Data Market

Xensor sensors can currently detect fire, leaks, power failures, and malfunction, and a new sensors with functions detecting air quality and floating population are on the way. Data collected by the sensors may be used to evaluate risks and prevent accidents. Demand for such data as well as the subjects of investigation are increasing with time. Danger-related information of a particular area is crucial for the automated services of smart cities. Xensor project aims to create a decentralized data market where the data collected from its sensors are put to practical use.

In addition to the danger-related data from its sensors, Xensor, with its second-generation models, will accrue even more data by targeting the POS market. Data that accumulates with the dissemination of Xensor gateways will by anonymized and encrypted to be uploaded in the data market, and when a buyer purchases the data with cryptocurrency, the supplier will also be rewarded.

3.3 XSR Token Economy

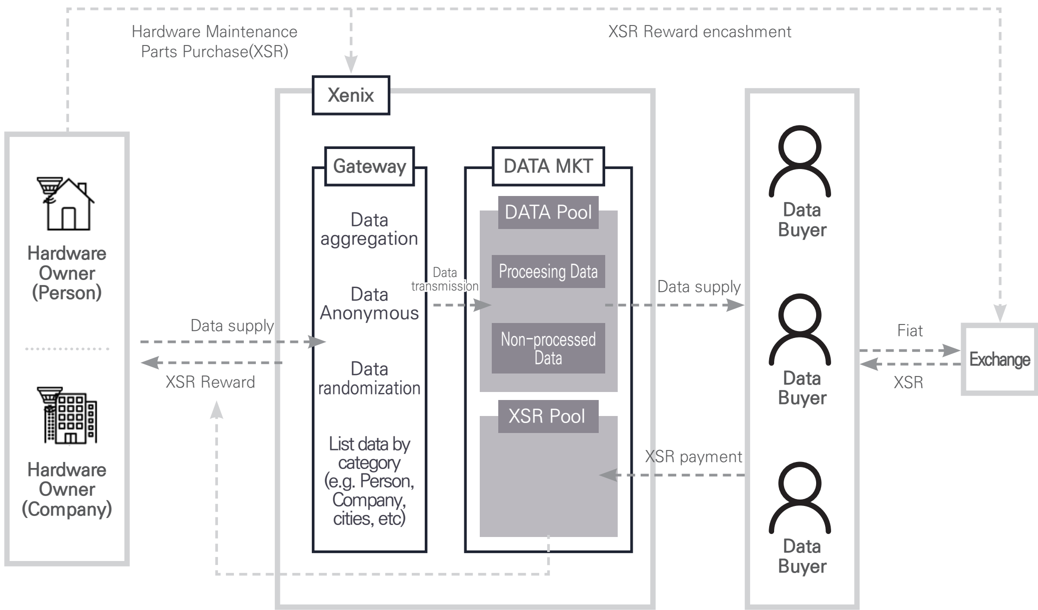
The token economy of Xensor project will be used to establish the aforementioned business model. Accordingly, the most important entity in Xensor's token economy is the Xensor hardware holder, who collects data from the sensors which play a key role in the business model and the token economy.

The Xensor team has decided that mining blocks by producing and verifying blocks is analogous to running business using Xensor sensors that produce and verify data. By the same analogy, the Xensor hardware holder corresponds to a node that produces and verifies blocks, and the act of producing data corresponds to mining blocks. Xensor's token economy will operate on such "data-mining" model.

The holder of the Xensor hardware can install an application provided by Xensor to check the amount of data collected by his or her hardware. Xensor will provide an opportunity for the holder to participate as a "miner" in Xensor's token economy by asking if he or she agrees to offer the data for the data market.

If the Xensor hardware holder refuses to offer the data, he or she will not participate in the token economy, and will receive neither rewards nor disadvantages. If the holder does indeed agree to offer the data, he or she will become a constituent of Xensor's token economy and receive rewards for offering the data.

[Fig 10] Xensor Token Economy Flow



The data collected from Xensor hardwares will be anonymized and edcrypted for the data market to remove any kind of personal information. This process will occur then the data reaches the Xensor gateway. Before being uploaded into the decentralized data market, anonymization and edcryption will automatically occur as the data are classified into corresponding categories. The purchaser will not be able to determine from whom or where the purchased data comes from, but will be able to examine the individual category of the data.

The data purchaser will need to purchase XSR tokens to purchase data from Xensor's decentralized data market. The Xensor hardware holder may sell his or her XSR tokens received as compensation for offering data in exchanges for fiat or other cryptocurrencies. The holder may also use the XSR tokens to purchase services rendered by Xensor, including solution services, hardware maintenance, hardware purchase, and communication network service. The data purchaser and the hardware holder propel the XSR token economy.

The XSR tokens paid by the data purchaser will be stored in the XSR Token Pool. After the deduction of a minimal fee required to operate the services, all the newly stored XSR tokens will be used to compensate Xensor hardware holders who offer their data.

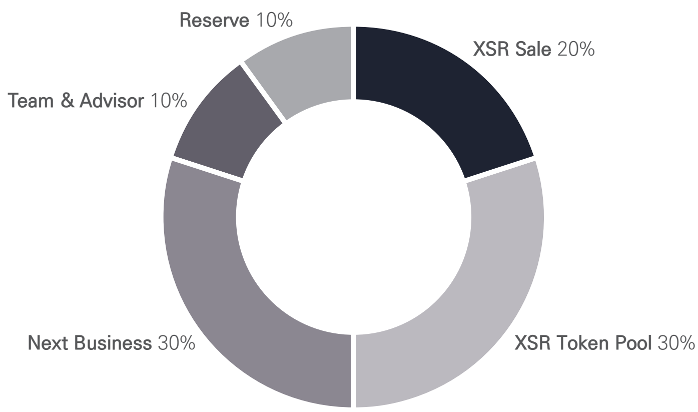
The amount of XSR tokens given as compensation for offering data will be determined after consideration of services that can be purchased using XSR tokens, including communication network fee and maintenance fee.

4 Token Information

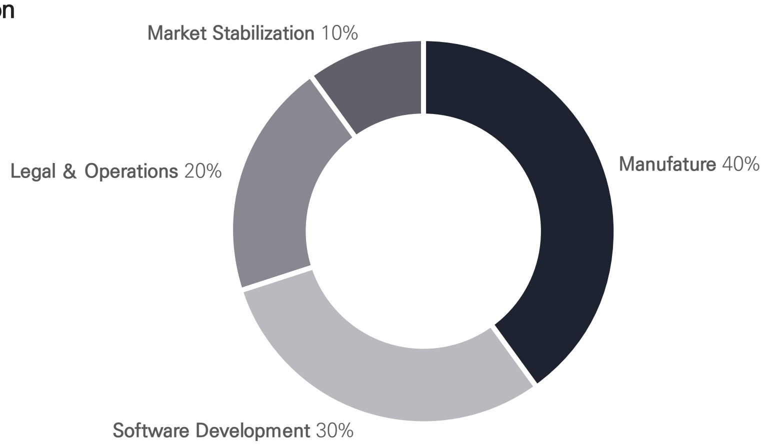
Xensor will manage "XSR Token Pool," supplied with a fixed number of XSR tokens, to reward the Xensor hardware users for providing data. Sixty-five percent of the initial circulating supply will be stored in the XSR Token Pool, but as the number of Xensor hardware holders increase, the stored tokens may deplete quickly. Therefore, the Xensor Team will use a portion of its profits to purchase XSR tokens from the market and store them in the XSR Token Pool.

The tokens in the XSR Token Pool will only be used to reward the Xensor hardware owners for providing data, and no entity will be able to approach the pool for other purposes.

1) Token Allocation



2) Fund Allocation



5 Roadmap

Business Roadmap	Development Roadmap
2019 1Q XS Token Private-sale XS Token Pre-sale	
2019 2Q XSR Coin crowd-sale Indonesian Factories Installations	
	2019 2Q XSR Project Launch
2019 3Q Vietnamese Factories Installations	
2019 4Q Korean retail Stores Installations	
	2019 4Q Fine Dust Sensor Launch xensor B2C device launch (xensor 2.0)
2020 1Q Xensor Network Installations in Miding Vietnam	
	2020 1Q Floating population sensort Launch
	2020 2Q Data Market

6 Team & Advisor

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Council Member of Songdo
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CEO of Drive T
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CEO of Evvo IoT
Executive Director
of CCM Group, SG
University of Texas, Austin

SDChain, CEO · David S. Pan

CEO of SD Chain
Director of IoT Asia
Marketing of Arm
Masters in Finance, Harvard
BA in UC Berkeley

Hexlant, CEO · Jinwoo Noh

CEO of Hexlant.

(former) Samsung Service Design
blockchain custody and wallet
Blockchain investment

**Samsung Games, CEO
Chikyu Bae**

Vice Chairman of Korea
Blockchain Content Association
Vice Chairman of Korea Mobile
Game Association

7 Business Partner

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