Expert Article

KASS-based safety maps for autonomous driving

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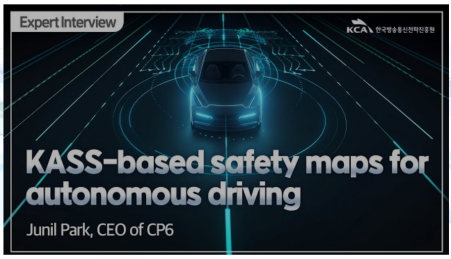
Contributed to inaugural Digital Industry and Law & Policy Review

#Systems for geolocation #KASS #Autonomous Vehicles #Connected Vehicles #GPS



Introduction

The automotive industry is undergoing a rapid transition from Connected Vehicles (CV) to Autonomous Vehicles (AV). Connected Vehicles rely on vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication to provide information to the driver for vehicle operation. In contrast, autonomous vehicles drive themselves using autonomous driving sensors such as cameras, LiDAR (Light Detection and Ranging), RADAR (Radio Detection and Ranging), and GPS (Global Positioning System) receivers, highlighting a key difference between the two.

To fully realize autonomous vehicles, various technologies are being developed, and the latest autonomous vehicles are also referred to as 'Software Defined Vehicles' (SDV). A software-defined vehicle differs from traditional vehicles that require visits to specific locations, such as service centers, for software updates. Instead, it allows software to be updated wirelessly to improve hardware performance. This concept is similar to improving the performance of a smartphone's built-in camera through application updates.

In order for autonomous vehicles to safely navigate roads, they must be accurately positioned on high-precision maps. However, the current GPS signal, with an error range of 15-33m, is not sufficient for the operation of autonomous vehicles. To address this issue, the Ministry of Land, Infrastructure and Transport is preparing to provide services by establishing the Korea Augmentation Satellite System (KASS), a Korean version of the Satellite Based Augmentation System (SBAS), known as the "Korean Precision GPS Positioning System". Once the KASS-based signal system is completed, the positioning error will be reduced to within 1-1.6 meters, enabling precise location-based autonomous driving, and it is expected that various services will be launched based on this signal system.

In this paper, we aim to briefly examine the need to develop safety map services for autonomous vehicles among various services based on the KASS signaling system, with a focus on international examples. Subsequently, we plan to describe the strategy for their domestic implementation.

Need for KASS-based safety guidance

[Figure 1] Street detection processing error

Limitations of autonomous driving based on high-resolution maps

High-precision maps used in connected vehicles based on GPS can be created and provided to drivers with detailed information such as the height of buildings, the width of sidewalks and roadways, and the height of utility poles. However, due to the inability to accurately mark the driver's location using high-precision maps, discrepancies between the vehicle's position on the map and its actual location are inevitable.

For example, as shown in [Figure 1], there are limitations in representing certain situations on high-precision maps, such as cases where the actual position of the vehicle cannot be accurately determined because road maintenance work is mistaken for a lane, leading to accidents (Malfunction 1), cases where lane markings are lost due to wear or accidents (Malfunction 2), and situations where lane markings are not detected due to heavy rain or other weather conditions (Malfunction 3).

An overseas case

In the United States, the SBAS signaling system has been fully implemented, providing accurate location information. Based on this, a prominent example of an autonomous driving service is the "Super Cruise Map" of the American automobile company GMC. The Super Cruise Map enables vehicles sold by GMC in the United States and Canada to recognize real roads through autonomous driving sensors, providing Level 3 autonomous driving services on more than 400,000 miles (643,737 km) of road (see below [Figure 2]).

[Figure 2] GMC 'Super Cruise' Service Department

Sweden has initiated the "Drive Sweden" project to provide safe and convenient safety map services for autonomous driving, using the SBAS signaling system developed by the European Union. As a result, vehicles manufactured and sold in Sweden, such as Volvo and Polestar, will be equipped with maps designed for autonomous driving in sections where real roads are detected. The project aims to be in operation by 2025.

KASS-based Security Map Construction Plan

Collect road environment data

As of 2022, the total length of domestic roads in South Korea is 114,314 km, which is 2.5 times the circumference of the earth (46,250 km), making it a very long distance. Moreover, the management of these roads is divided between the central government and various local governments, making the task of creating an autonomous driving safety map for all domestic roads a challenging endeavor. Currently, the Ministry of Land, Infrastructure and Transport operates vehicles to measure the autonomous driving road environment, but with only about ten such vehicles in operation, it is difficult to comprehensively assess the condition of domestic roads. To address this, consideration should be given to leveraging the 97,273 official vehicles owned by central and local governments (as of November 2022). Since more than 99.5% of these registered official vehicles are equipped with basic autonomous driving sensors and are level 2 or higher, collecting road information from the sections these vehicles travel could enable the collection of a wide range of data. These include sections where autonomous driving is impaired due to lane maintenance, sections where autonomous driving is impaired due to lane marking wear, and sections where autonomous driving is impaired due to heavy rain.

[Figure 3] SBAS-based autonomous driving safety map service using autonomous driving sensor data for public vehicles (example)

Leveraging Collection Data

The data collected by the autonomous driving sensors of the official vehicles can be incorporated into the traffic information provided by the road authorities to the drivers, as shown in [Figure 3], providing real vehicle-based autonomous driving information. By using the KASS signaling system, it will be possible to determine the success rate of autonomous driving for each lane within the same road section, such as the success rate for the first lane and the second lane. This would enable the provision of a more accurate and safer autonomous driving safety map service.

Conclusion

Both related agencies and the industry agree that services based on the more accurate KASS signal system, rather than the current GPS signal system, are necessary for the safe operation of autonomous vehicles. Based on this, the creation and distribution of autonomous driving safety maps will enable the rapid expansion of the domestic market for autonomous vehicles. In addition, such autonomous driving safety maps can serve as a foundation for building a new industry ecosystem based on autonomous vehicle data.

Reference

1) Article 2, Paragraph 1, Item 1 of the Act on Promotion and Support of Commercialisation of Autonomous Vehicles defines an "autonomous vehicle" as "a vehicle capable of operating itself without the operation of a driver or passenger in accordance with Article 2, Paragraph 1, Item 3 of the Automobile Management Act".

2) In order for autonomous vehicles to recognise and judge their surroundings, they need to collect information using cameras that are equivalent to the human eye. The number of cameras required for autonomous driving may vary depending on the car manufacturer, but the minimum is two front and rear cameras, and the maximum is eight, including front, rear, left, right, and blind spots.

3) Lidar, or "Light Detection And Ranging", is a device that uses light to measure the distance of objects and collects information to determine the position and distance of objects in front of it. Lidar is also used in robot vacuum cleaners and other household appliances.

4) It is a device that transmits electromagnetic waves to obstacles in front of it and collects information such as the speed, distance, and angle of the object in front of it by reflecting back the values.

5) GPS originated as NAVSTAR GPS for military applications such as weapons guidance, navigation and surveying, mapping, geodesy, and time synchronisation by the US Department of Defense, and is now used as a civilian global positioning system, with more than 24 satellites providing location information services around the world.

6) Ministry of Land, Infrastructure, Transport and Tourism, Press release, "KASS (Korean Air Satellite Service) to Improve the Accuracy of Location Information," Aviation Policy Division, 27 July 2023, p. 1.

7) See Korea Aerospace Research Institute, "Korean Precision GPS Positioning System (KASS)," Korea Aerospace Research Institute website (https://www.kari.re.kr/kor/sub03_08_02.do, last visited 24 December 2023).

8) Ministry of Land, Infrastructure and Transport, supra note 1, at 1.

9) This is a screen capture of the drive record (dashcam) of a research vehicle of CP6, which was involved in an accident due to an actual lane recognition error.

10) Autonomous driving is considered to be level 3 when the driver's hands and feet are free during driving according to the SAE J3016 standard set by the Society of Automotive Engineers.

11) See GMC, "What Is Super Cruise?", GMC website (https://www.gmc.com/connectivity-technology/super-cruise, last visited 24 December 2023).

12) A non-profit project organisation created by the Swedish government, large Swedish companies such as Volvo, Polestar and Ericsson, and start-ups to develop and supply mobility solutions for sustainable transport systems.

13) mobilityXlab, a sub-project of Drive Sweden, is conducting various studies on safety mapping. See mobilityXlab website (https://www.mobilityxlab.com/, last visited 26 December 2023).

14) Office for National Statistics, "Total length of roads and motorways", Office for National Statistics website (https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1ZGA84, last visited 24 December 2023).

15) See Shin Jonghoon, "Analysis of the Current Status of Domestic Automobiles," Integrated Data Map website (https://www.bigdata-map.kr/datastory/new/story_54, last visited 24 December 2023).

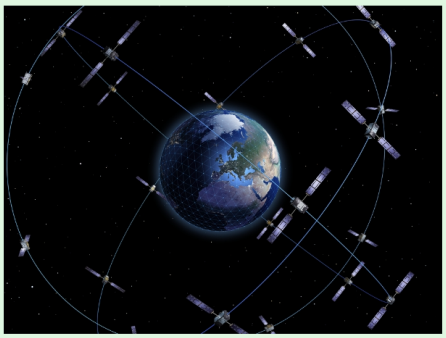
16) Park, Sang-Hyun, "Global Industry Trends of Autonomous Vehicles," KDB Industrial Bank of Korea, Industrial Research Bulletin, No. 801 (August 2022), p. 53.

GNSS Utilization Technology Trends

Global Navigation Satellite System (GNSS) is a system that uses artificial satellites to accurately determine the position of a target object. It is one of the key technologies of the Fourth Industrial Revolution and is widely used in next-generation mobile communications and smart mobility, where accurate location information is required. In particular, with the rapid development of the smart mobility industry, the use of GNSS in intelligent transportation systems is prominent.

#Global Navigation Satellite System #Smart mobility #D-GNSS #Drone #UTM

Satellite Navigation Industry Trends



Source: ClipartKorea

Global investment bank Morgan Stanley has predicted that the GNSS market will grow to $177.3 billion by 2040, up from $98.3 billion in 2018. This has focused attention on both the upstream industries that provide GNSS-enabled services to consumers and the downstream industries involved in component development. The number of GNSS receiver users is expected to reach 6.5 billion by 2021, with a compound annual growth rate of 10%. Revenues for both the upstream and downstream industries are also expected to grow at a CAGR of 9.2% to €49.2 billion by 2031 (based on €19.9 billion in 2021).

Utilization of the Satellite Navigation System of Smart Mobility

D-GNSS of Intelligent Transportation Systems

D-GNSS stands for Differential Global Navigation Satellite System, which is designed to eliminate errors that occur in traditional satellite navigation systems. It serves as a complement or enhancement to independent satellite navigation systems such as GPS. Accurate D-GNSS positioning data is essential for efficient Intelligent Transportation Systems, enabling monitoring of vehicle conditions such as speeding, congestion, and accidents.

D-GNSS data can be effectively used in bus operations. The data is used for speed analysis, monitoring vehicle congestion, estimating average route travel time, and analyzing driver fatigue. By using D-GNSS positioning data, it is possible to determine whether a bus has stopped at a designated bus stop and to estimate the average travel time based on segment-specific time data.

Source: ClipartKorea

Source: ClipartKorea

Self-driving truck platooning

Autonomous driving refers to a system in which a vehicle can drive itself by sensing the driving environment without human input. Recently, the application of autonomous driving has been actively expanding beyond passenger cars to vehicles such as trucks, drones, and buses. In particular, autonomous trucks are characterized by high stability and cost-effectiveness. Using satellite navigation systems, they can assess road infrastructure and driving conditions, optimize operations to save fuel, and avoid unnecessary braking.

In 2021, South Korea's Ministry of Land, Infrastructure and Transport demonstrated the cluster driving (formation, maintenance and separation) of four autonomous trucks and the cluster driving matching service for the first time in the country at the Final Outcome Presentation of Autonomous Cooperative Cluster Driving Research and Development for Trucks. The demonstration took place on an approximately 80 km section of the Yeongdong Line and Central Inland Line highways. The successful process of sequentially merging and separating the autonomous driving trucks from the first to the fourth vehicle was demonstrated.

A self-driving drone

Autonomous drones are currently being developed or piloted by companies such as Amazon in the United States and DHL in Germany. Autonomous drones are particularly advantageous for their ability to precisely deliver to high-rise buildings or apartment complexes, thanks to the use of satellite navigation systems that provide accurate location information.

UTM (Unmanned Traffic Management) is a prominent example of the use of autonomous drones in traffic management systems. Recently, the EU launched a UTM pilot project called EuroDRONE. The operation of EuroDRONE begins with the upload of waypoint information, including GPS coordinates and speed. The drone verifies the uploaded information, along with weather conditions and starting position, to determine whether the flight is authorized. During the flight, the drone continuously receives GPS data and calculates the distance to the destination, allowing it to draw flight trajectories in real time. This demonstration served as an opportunity to validate UTM's technology and services, and to explore potential future developments.

Source: ClipartKorea

Reference

-"Satellite Navigation"... Industry Trends

Developing high- performance domestic XR devices to implement metaverse content

P&C Solution Co., Ltd.

Core Technologies and Achievement Highlights

- Holding core technologies needed for AR glass design and production
- Succeeded in mass production of HMD-type AR glass for the first time in Korea
- Contributed to the growth of the domestic AR/XR market by continuous R&D on products
- Globalize content to enter the North American and European market

Succeeded in mass-producing the best AR glass in Korea

The non-face-to-face lifestyle brought about by COVID-19 has brought about numerous changes in our lives.Among them,augmented reality(AR),extended reality(XR),and the metaverse have experienced significant growth.These technologies are currently in the spotlight as major advancements that will lead the development of the future Internet,leading many companies to conduct extensive research and development in these fields.P&C Solution is a specialized company in AR and XR technology.They develop AR glasses and XR simulators utilizing AI technology,and also provide XR solutions,particularly in the educational field.For their AR glasses,P&C Solution has developed digital twin and remote collaboration solutions using AI-based technology.They have also undertaken projects in the areas of national defense,medical services,and construction,focusing on safety and mastery training.In particular,P&C Solution started to develop AR glasses in full scale from 2017 and hold all unit technologies necessary for design and production.P&C Solution succeeded in mass-producing the highest-level finished product in Korea.In recognition of such technological prowess,P&C Solution received the Innovation Award at the world's largest IT fair CES2023.The award is given to the innovative technology and product that will the world.

Created mass production version through the ICT Funding Project

The ICT Funding Project supported P&C Solution's"metaverse content global project."Currently,the global digital content market is experiencing a growth rate of over 10%annually.In particular,new industries such as AR,XR,and the metaverse are expected to see explosive growth worldwide.According to data released by Statista,a specialized market research firm,in March 2022,the total AR/VR market(both domestic and international)reached approximately USD 27.96 billion in 2021 and is projected to reach USD 252.16 billion in 2028,an increase of about tenfold.P&C Solution could develop a mass production version of customized AR glasses,which remained at the prototype level,thanks to the support of the Fund Project,and received a lot of help in making a final product that can pass the environmental test and evaluation.The AR glass Metalense and XR smart factory integration solution Metawin,which were completed in such a way,are customized for industries and support the remote collaboration function based on AR and XR.These products improve business efficiency and stability but reduces risks through the entire industry,including manufacturing,construction,logistics,and national defense.

Gained a foothold in entering overseas markets

P&C Solution applied for the"Metaverse content global project"in order to explore future business opportunities with limitless growth potential.However,prior to participating in the Funding Project,P&C Solution faced challenges in entering the international market.Despite having top-tier technology in Korea,the company lacked brand recognition.The Funding Project played a vital role in addressing this issue.By being selected for a support project by a reputable institution like the National IT Industry Promotion Agency,P&C Solution was able to enhance the credibility of its brand.Additionally,the support fund enabled the company to engage in more active public relations activities.P&C Solution enhanced the accessibility to potential global customers by creating localized PR materials,including information kits and websites,as part of the Funding Project.The company also actively participated in global exhibitions and business meetings to increase global awareness of its content and identify potential customers.Furthermore,P&C Solution seized the opportunity to gain a comprehensive understanding of marketability and enhance its evaluation capabilities through systematic content evaluations.Simultaneously,the company built a foundation for market entry by improving its brand value and credibility through the dissemination of content production news via social media channels.

The firm determination of AR/XR specialist company create infinite possibilities for success

The entry barrier for small and medium-sized businesses in the AR/XR industry to access overseas markets is excessively high.However,P&C Solution stands out with its vast potential,possessing core technologies in both hardware and software for AR glass production.The company has garnered global attention by winning prestigious awards at world-class exhibitions.This recognition has translated into increased interest from various software developers in the target overseas markets,including Europe and the United States,which P&C Solution aims to enter.Rather than resting on its laurels,P&C Solution is actively driving forward to expand its market presence.The company is undertaking various initiatives to penetrate overseas markets.These efforts include diversifying its business through collaborations with industrial AR solution providers,securing a larger market share by establishing and expanding overseas distribution channels,raising brand awareness,and establishing a subsidiary in the United States.As the domestic small and medium-sized business have started to enter the global market with its own technology,let's expect the day when P&C Solution's AR glasses step into the global metaverse market and stand out as a leading company,just as a small waterway connects a large sea.

ICT Funding Project

- **Dedicated Institution** National IT Industry Promotion Agency
- **Business Objective** Revitalizing digital content industry ecosystem(Informatization)
- **Business Description** Revitalizing digital content industry ecosystem(Informatization)

Company information

- **CEO** Choi Chiwon
- **Type of Business** Hardware development and manufacturing
- **Year of Establishment** 2015. 03
- **Website** www.pncsolution.co.kr

TIME LINE

2015. 3.
Established P&C Solution Co., Ltd.

2016. 6.
Developed ARVR006 spatial touch and gesture recognition technology

2017. 5.
Developed a medical VR system

2017. 12.
Attracted investment of KRW 1 billion from Korea Technology Finance Corporation

2018.
Acquired quality management system certification (ISO 9001:2015)

2019. 4.
Received the 30th anniversary plaque from Korea Technology Finance Corporation

2020.6.
Acquired PANDRIZ Certification

2021. 1.
Selected as an excellent potential company by Seoul Business Agency

2021. 5.
Selected as Baby Unicorns company by Korea Institute of Startup & Entrepreneurship Development

2022. 7
Selected as an excellent R&D innovative product in the first half of 2022 (Ministry of SMEs and Startups)

2023. 1.
Received the innovation award in the virtual & augmented reality category at CES 2023

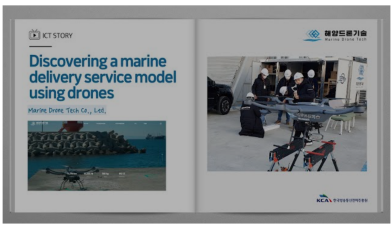
Marine Drone Tech Co., Ltd.

Core Technologies and Achievement Highlights

- Commercialization of drone delivery services for marine use for the first time and expansion to paid services

- Certification of drone operation stability due to the expansion of drone delivery capabilities, expansion of commercialization target region, and application of drones to various business fields

- Established reliability for its own drone R&D capabilities and training programs.



An innovative platform that connects ships and local commercial area

"2023 drone company investment briefing"

Currently,many companies around the world are promoting businesses using drones.In particular,interest in the delivery industry is hot because it is expected to have positive effects such as convenient delivery to isolated areas and carbon reduction as well as cost and time savings.Marine Drone Tech Co.,Ltd.identified the potential of such drone delivery service.Recognizing the need to spread services for marginalized targets such as sailors,it was established in September 2018 to promote the welfare of sailors.Since then,it has succeeded in commercializing drone delivery for the first time in Korea in 2021.It also developed the Naraon Application that supports maritime drone delivery,leading the innovation in Last-Mile Delivery through the elimination of blind spots in logistics and practice of non-face-to-face delivery and carbon neutrality.In May 2021,it was selected as one of the government's 1000 National Representatives of Innovative Companies and was recognized for its innovation and technology.In addition,it has won numerous awards and completed about 800 deliveries by commercialized delivery drones,and it continues to set new records.Marine Drone Tech manufactures and operates drones with enhanced performance specializing in maritime operations.As the basis for drone commercialization is stable drone operation,we are securing the reliability of drones and operating systems with expertise acquired through experience in repeated demonstration flights.We operate the Flight Education Center,a specialized educational institution designated by the Ministry of Land,Infrastructure,and Transport.With it,we foster excellent drone operators through the latest education based on extensive practical experience and customized career education for the 4th industry.It was also certified by the Ministry of Education as an excellent institution that provides career experience as an educational donation.

Key challenges are expanding drone delivery capabilities

Marine Drone Tech had to improve existing drone delivery capabilities through the"manufacture of high-quality marine drone prototypes to expand marine delivery last-mile delivery capabilities"project implemented as an ICT Funding Project.This was a task that Marine Drone Tech must accomplish in order to lead the delivery market using drones,not to mention the biggest challenge to overcome.To this end,we set the following detailed tasks:1.Increase the transportable cargo weight per operation from 3kg to 5kg.2.Extend the delivery distance from 3km to 8km.3.nhance wind resistance from 8m/s to 10m/s considering the wind characteristics of the ocean.All three were essential factors for expanding marine drone delivery services and ensuring stability in operation.The outcome was successful.Through this challenges,Marine Drone Tech could technically overcome distance,weight,and weather limitations.Moreover,the scope of drone delivery service was expanded by promoting the expansion of delivery capacity and expanding the service region to the anchorages of Yeosu and Gwangyang Port in addition to the existing service area of Busan's southern outer port.Even now,we are participating in the drone demonstration city project in Yeosu-si and actively discussing commercialization with other local governments, such as Ulsan and Tongyeong-si.

Endless challenge, infinite possibilities

Compared to drones operated on land,there are few cases of drone production specializing in sea delivery.Therefore,the demonstration process was repeated several times,and there were difficulties accordingly.RF signals were cut off due to peripheral failures,even for LTE communication,control was also restricted in the shadow area,or we could not find the ship's hull until the end when operating in limited visibility.Thanks to such situations,however,we were able to acquire extensive knowledge to improve drone performance,e.g.,waterproof treatment needed when flying in fog,method of fixing cargo influencing flight stability considerably when demonstrating actual cargo delivery,etc.The possibility of drone delivery services development is endless in the domestic and global markets.Marine Drone Tech will continue to pioneer markets to apply technology based on stable drone operation.We are striving to expand the commercialization regions not only in Korea's major ports and islands of each province but also in Peru,Singapore,and Indonesia,which have a large volume of port traffic.

Deregulation of drones, a must-solve challenge to enter the global market

Before expanding the commercialization market to the world,it is necessary to supplement the regulatory aspects.We must comply with the Aviation Act and Customs Act to provide drone delivery services.For the continuous development of the drone industry,active regulatory review should be preceded concerning the commercialization of drone delivery in line with the expansion of drone delivery capabilities.Currently,the market for drones is growing worldwide.To preoccupy these markets,countries worldwide,including the United States,Japan,and Europe,are strengthening mutual efforts between the private sector and the government.We hope Korea will also create circumstances to lead the industry through regulation rather than the regression of related technologies and businesses due to regulation.

ICT Funding Project

- **Dedicated Institution** National IT Industry Promotion Agency
- **Business Objective** SW Convergence Cluster 2.0
- **Business Description** SW Convergence Cluster 2.0

Company information

- **CEO** Hwang Uicheol
- **Type of Business** Manufacturing
- **Year of Establishment** 2018. 9.
- **Website** www.marine-drone.co.kr

TIME LINE

2018. 9.
Establishment of Marine Drone Tech

2020. 10.
Development of delivery drone (MDT-40D)

2021. 2.
Acquisition of drone delivery business license for the first time in Korea (Busan Regional Aviation Administration)

2021. 5.
Selected as one of the government's "1000 National Representatives of Innovative Companies"

2021. 6.
Establishment of Marine Drone Tech Co., Ltd.

2021. 12.
Awarded commendations from the Busan Regional Aviation Administration and Minister of Land, Infrastructure, and Transport

2022. 3.
Development of drone delivery platform Naraon application

2022. 5.
Signed MOU with Busan Coast Guard

2022. 8.
Expansion of drone delivery service to Port of Gwangyang, Yeosu

2023. 2.
Establishment of JV with Sky ports in the UK

2023. 4.
Opened the Naraon Drone Delivery Center

Blockchain makes donating even more enjoyable, as the world becomes 1°C warmer

E4 NET Co., Ltd.

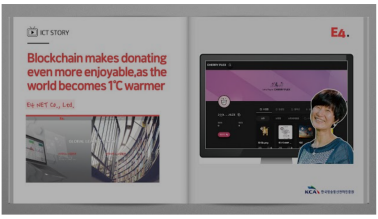
Core Technologies and Achievement Highlights

- Development and supply of financial solutions in areas such as card, payment, membership/loyalty programs, etc.

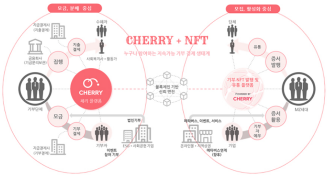
- Provision of professional translation, interpretation, multilingual, and machine translation services, along with AI data construction

- Selected for the 2019 Blockchain Private-led National Project organized by the Ministry of Science and ICT and KISA, for the establishment of a blockchain-based donation platform called Cherry

- Implementation of donation NFT issuance and construction of a distribution platform



Warming the world with IT technology, E4NET's vision



In the modern world,the utilization of blockchain technology for data storage has become widespread.It can be applied in various fields, not only for electronic payments and digital authentication but also for verifying the authenticity of art,preventing counterfeit currency, and managing medical records across different hospitals.In particular,transactions involving Non-Fungible Tokens(NFTs), which leave a permanent record on the blockchain, ensure the uniqueness of each item as no identical product can exist. If this technology is implemented effectively,it has the potential to transform financial transactions and contribute to a better world. E4NET's"Cherry"project originated from this belief and vision.E4NET,founded in 1995 by e-commerce/B2B experts, is a company specializing in internet-based transactions among enterprises and financial value-added systems. Over the years,it has built a strong track record in mobile commerce services,leveraging smart devices,as well as providing blockchain-based services,SI construction, and neural network-based machine translation and learning data construction. With a forward-looking approach,E4NET has been actively involved in blockchain technology since 2018,in anticipation of the Fourth Industrial Revolution, and has embarked on full-scale development efforts. "Blockchain technology has the potential to provide transparency and reliability by theoretically disclosing all transaction records. After being deeply interested in donations and supporting the work of organizations for over 20 years,I realized that the biggest challenge faced by these organizations is fundraising. I believed that by leveraging the strengths of blockchain in the context of donations,we could establish a sustainable donation model,"explained CEO Lee Soojeong. The development of the donation platform commenced with this vision, and it was officially launched as"Cherry"in December 2019. The platform allows users to donate to organizations and individuals at any time by charging tokens after user authentication through the app. To enhance user convenience,we integrated various financial systems, including simple payment systems. Above all,we recognized that the declining donation rate,which decreases by 10%annually,was primarily due to"distrust." Therefore,we prioritized transparency by disclosing every aspect,from the fundraising process to the utilization of funds,in order to rebuild trust."Moreover, the COVID-19 pandemic has acted as a catalyst for Cherry's rapid growth,as traditional donation methods such as street fundraising or events became increasingly difficult. The platform gained momentum through representative donation campaigns,including walking events and SNS dance challenges,which received enthusiastic responses from the younger generation, particularly those in their 20s and 30s. As a result,Cherry has achieved remarkable milestones,with a cumulative donation amount of KRW 9 billion,1,634 campaigns conducted,and 122,196 donation transactions completed over the course of three years. Additionally,E4NET demonstrates its commitment to giving back by donating 10%of the company's profits annually.

A wonderful day for donations: the NFT donation ecosystem leading to cherry world

In 2022,E4NET expanded Cherry's scope from being a donation platform to becoming a social impact community.The focal point of this expansion lies in the utilization of NFTs.As part of the ICT fund support project,E4NET actively sought to accumulate expertise and validate the underlying technology of Cherry known as the"Solare Main Blockchain Technology."Solarea was chosen for its fast transaction speed and low costs.However,the development process presented challenges in terms of stability,as the processing performance was not initially consistent.However,as a result,the system was successfully linked and expanded to the cherry platform,expanding the base of inflow of new donors.The"Green Fruit NFT Sharing Campaign"held with SBS in May 2022 was a representative achievement.At that time,it issued 5,000 NFTs in large quantities and successfully held a large-scale event to donate NFTs for the first time in Korea.While confirming the technical value and status of the product,at the same time,it was evaluated that it contributed greatly to the evitalization of the donation culture through the platform.Based on this momentum,the evolved ecosystem known as Cherry World emerged.E4NET crafted a compelling narrative called"Good Consumption"within a virtual space,establishing a distinct worldview.The primary focus is on a target group called"Cherishers,"who are"Good Consumers"empowered with a fresh economic outlook.Within this ecosystem,NFTs with unique identification numbers are utilized for donations,allowing donors to be recognized and providing them with the opportunity to profit from NFT sales through distribution.Furthermore,a self-sustaining cycle is established by allocating a portion of the profits for further donations,thus activating the spirit of giving.For example,if you reduce carbon emissions by walking instead of using a car,a reward is provided as compensation.Cherishers receive NFTs through activities in their respective spaces and can use them like membership for buying mobile coupons or items or for interacting with Cherishers in other spaces.10%of the reward is automatically donated under the user's name.

Dreaming of a donation every day without constraints of time and space

Cherry continues to make significant strides in its journey of progress.In January,it successfully completed the spin-off and establishment of Cherry Co.,Ltd.as a new independent corporation.In April,Cherry launched the"Cherry World"online reward app,which has gained tremendous popularity.Particularly,the response from young people has been remarkable,with users in their 20s and 30s constituting more than 50%of the total user base.In today's world,where corporate social responsibility holds great significance,social impact communities like Cherry provide excellent opportunities and justifications for companies to engage in meaningful activities.The concept of benefiting everyone involved has become a reality.Moving forward,Cherry plans to further expand its services,including advertisements,mobile coupons,special NFTs,digital items,games,and more.As the Metaverse community gains momentum,Cherry World's direction will also be influenced by the community,ensuring a collaborative and community-driven approach.We will continue the supplementation of Solarea Blockchain,Still,sometimes the network is unstable,so we must prepare an efficient quality management algorithm to provide stable blockchain functions within the app.Also,as it is a growing network,the advancement of NFT technology itself is rapidly progressing,so we need a prompt update response for that.E4NET has future plans to explore business opportunities utilizing NFT and De-Fi technologies.NFT,as a technology that proves ownership,carries immense implications beyond its basic function.It has the potential to become a crucial factor in the digital economy,enabling the universal flow of assets without being limited to any specific platform in the digital environment.The possibilities are vast and far-reaching,and E4NET aims to leverage these technologies to drive innovation and create new business models in the digital economy.We hope that through more fun and exciting donation adventures,E4NET's dream of becoming a spark of desirable social change for future generations will come true as soon as possible.

ICT Funding Project

- **Dedicated Institution** National IT Industry Promotion Agency
- **Business Objective** Creating a foundation for blockchain utilization
- **Business Description** Fostering blockchain-specialized companies

Company information

- **CEO** Lee Soojeong
- **Type of Business** Application software development and supply
- **Year of Establishment** 1995. 11.
- **Website** www.e4net.net

TIME LINE

1995. 11.
Founded Jusson IT (converted to a corporation in 1997, changed company name to E4NET Co., Ltd. in 2000)

2000. 6.
Developed NexChange XML/EDI Messaging Server

2004. 5.
EAMS solution released (NexChange)

2007. 5.
Presidential Citation for Model SME

2007. 12.
South Korea Software Technology Grand Prize

2010. 10.
Venture Business Grand Prize 2010, Minister of Knowledge Economy Award

2011. 10.
The Industrial Service Medal, Venture Business Grand Prz

2018. 7.
Founded M-Brain Blockchain Laboratory

2019. 3.
Selected as the 2019 Blockchain Private-led Project by the Ministry of Science and ICT and KISA

2019. 12.
Awarded by the Minister of Science and ICT, received Venture Startup Promotion Award, Cherry Donation Platform Service Open

2022. 5.
Selected for NIPA Blockchain Technology Verification Project by the Ministry of Science and ICT

2022. 10.
ISO Blockchain Standard Case registration

Dominate the global market with advanced medical technology and AI healthcare services

Sungmin Networks

Core Technologies and Achievement Highlights

- Streamlining manual work by implementing an automated API for registering obesity management data
- Developing a cost-effective and efficient smart healthcare system
- Enhancing competitiveness by offering small and medium-sized hospitals access to high-quality obesity management medical data

Sungmin Networks, a leading company specializing in medical customer management solutions

Efficiently managing complex medical systems requires cutting-edge technologies and solutions.Sungmin Networks Co.,Ltd.specializes in developing software(SW)tailored for medical customer management(CRM)and computer telecommunication technology(ICT)to enhance the efficiency of medical services and patient treatment processes.Presently,the company provides CRM and CTI solutions to approximately 200 small and medium-sized hospitals,including ophthalmology,dermatology,obesity management,and women's hospitals.The standout feature of Sungmin Networks'CRM solution lies in its ability to seamlessly handle various aspects,from marketing and customer consultation to appointment scheduling,examinations,and post-surgery follow-ups.Leveraging these technologies,their ophthalmology CRM solutions hold over 80%of the domestic market share,while their plastic surgery CRM solutions have gained recognition overseas,including successful exports to China.In 2020,the company embarked on expanding into international markets and developed a medical cloud CRM solution with the support of NIPA(National IT Industry Promotion Agency).Furthermore,they have obtained certification from the Korea Association of Cloud Industry(KACI).Currently,Naver Medical Cloud Zone is collaborating with Sungmin Networks to create new value in the domestic medical CRM paradigm through the development of a CRM solution.

Managing obesity with AI and big data

Photo of Cloud Expo Korea 2022 consultation

Currently,people's interest in health management is increasing worldwide,and demand for services using medical data is also growing accordingly.In particular,with the increasing need for managing obesity which is classified as a chronic disease the demand for services using high-quality data for this purpose is increasing.Sungmin Networks,which has been paying attention to this,participated in NIPA's cloud computing industry fostering project in 2022 and carried out cloud-based software-as-a-service(SaaS)development and commercialization tasks.Considering the fact that the cloud which leads AI-based industrial innovations the core infrastructure of the digital economy,it is a support project for accepting the paradigm change in software use,recognizing the importance of SaaS,and fostering competitive cloud companies by veering away from the purchase-and construction-oriented method of the domestic SW industry.Through this project,Sungmin Networks developed an obesity management care solution that combines AI technology and big data technology.The solution was developed by integrating data collected by Sungmin Networks,which provides diet management,obesity management,and medical treatment services.It is characterized by supporting the scientific diagnosis and prescription of obesity management by providing convergence information to the doctor in conjunction with the medical service.In addition,a great advantage is that low-cost,high-efficiency obesity management and treatment are possible,so small and medium-sized hospitals can use it without financial burden.To date,certification with the Korea Association of Cloud Industry(KACI)and patent and trademark registration have been completed,and sales are increasing due to the increase in customers.Sungmin Networks will continue to expand cloudbased mobile healthcare services in the future.For this purpose, we plan to supply self-developed mobile healthcare services to medical institutions and sports centers that manage obesity and to prepare a system that enables users to access health information easily anytime,anywhere.In addition,we plan to develop AI-based healthcare data analysis services further to come up with AI algorithms that can analyze and predict health data.

Dominating the global market with obesity healthcare services

According to data reported by market research firm GIA(Global Industry Analysts),the global digital healthcare market is expected to grow from $152 billion in 2020 to $509 billion in 2027.In line with this,Sungmin Networks is making various efforts to advance into the global market.First,it secures dedicated personnel to protect technology and advance into overseas markets and strives to provide customized software to related hospitals and medical institutions overseas.Furthermore,Sungmin Networks actively engages in promotional activities.They adopt aggressive marketing strategies,such as participating in international expos like"GITEX 2023"in Dubai and engaging in export consultations with overseas buyers.Notably,their NIPA-supported project has gained traction overseas,and they have reached an agreement with a US hospital to enter the US market in 2024.Currently, a related system is being developed to facilitate this expansion.The future society is expected to have higher demand for digital healthcare services due to an aging population.Sungmin Networks plans to expand to overseas markets by developing services that support various languages and which are tailored to the characteristics of the country.We hope to see the day when Sungmin Networks will preoccupy the global healthcare service market beyond Korea.

ICT Funding Project

- **Dedicated Institution** National IT Industry Promotion Agency
- **Business Objective** Fostering of the cloud computing industry(informatization)
- **Business Description** Revitalize cloud services and strengthen corporate competitiveness

Company information

- **CEO** Cha Myungil, Seo Kwangseok
- **Type of Business** Software development and supply
- **Year of Establishment** 2009.
- **Website** talkcrm24.com

TIME LINE

2009.
Established Sungmin Networks Company
Established and commercialized CRM and CTI solutions for hospitals specializing in vision correction

2012.
Constructed CRM and CTI solutions for hospitals specializing in plastic surgery

2016.
Carried out export and OEM supply of CRM solutions for plastic surgery clinics in Vietnam and China

2019.
Developed an advanced AI vision correction surgery prediction solution and successfully implemented an AI OCR solution
Signed a program contract with Shanghai Lige Hospital in China (Export)

2021.
Established an AI analysis and automatic management solution linked with eye disease EMR medical data

2022.
Selected as a non-face-to-face voucher supplier by the Ministry of SMEs and Startups
Received the 'Top Excellence Award' for Excellent Workplace Management Certification in Reading
Selected as a company for Leisure-Friendly Certification
Received an award in the Digital Health category of the 2022 Core Industry Cloud Flagship Project Business