

TURBINECREW CORPORATION INTRODUCTION

Turbine Crew Inc.

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OUR SERVICE

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Turbine Crew Vision And Management Philosophy

TurbineCrew is creating a foundation for continuous growth through independent technology development and research activities. We are currently applying for patents for smart systems and artificial intelligence systems, and we are enhancing our business competitiveness through trademark applications for our integrated brand.

In addition, the ESS (Energy Storage System) made by storing renewable energy in recycled batteries received good results in test reports. Together with professors and the board of directors, including Ph.D. and master's degree members, we are achieving excellent results in various fields. This is helping related industries that are "growing together" with TurbineCrew's technology to grow as well. With TurbineCrew's green energy development, we will resolve power imbalance and contribute to creating a sustainable Earth..

VISION ESG Management

환경
Environmental

+

사회
Social

+

지배구조
Governance

TurbineCrew's vision is to develop a new form of wind power, viewed through artificial intelligence, and to utilize the wind generated by vehicle traffic on road medians to generate electricity. We aim to become a company that pursues beautiful Earth and ESG through eco-friendly electricity.



TURBINE CREW CI



Clebine BI

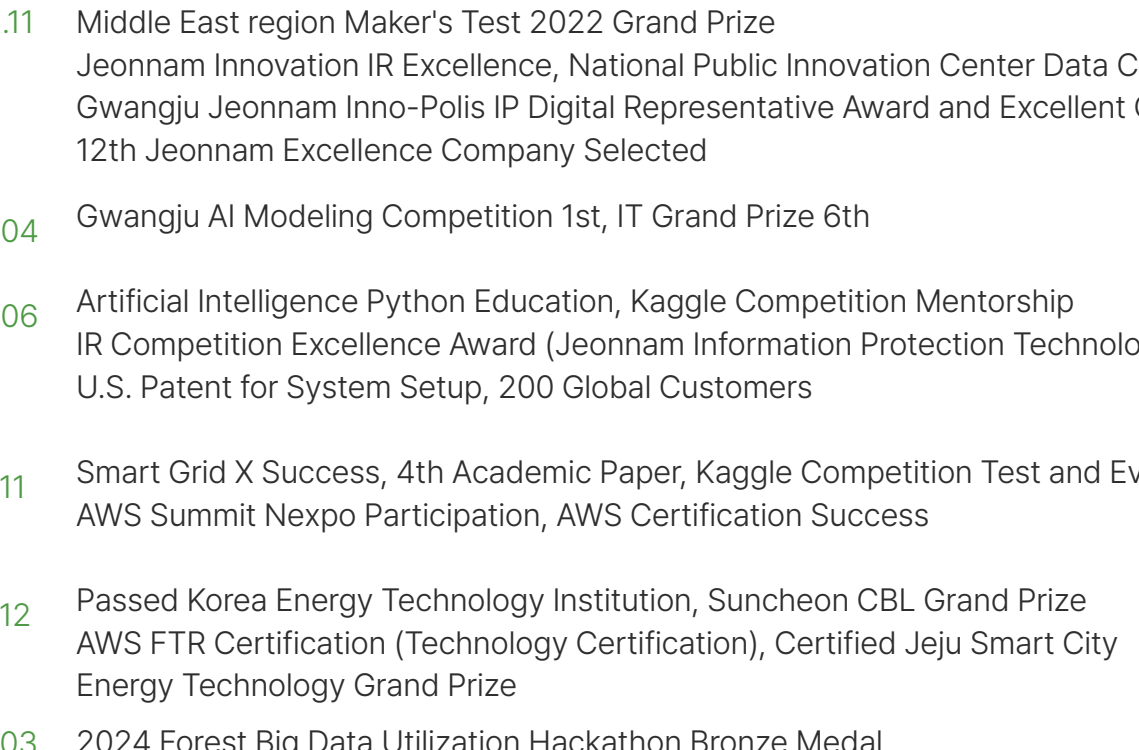
CI - The design evokes the image of a turbine, symbolizing sustainable and eco-friendly energy. It represents the determination to achieve the best results through sustainable energy solutions.

BI - This design characterizes wind power, a type of renewable energy. The energy of the sustainable and circular Earth is represented by an arrow, and the natural, eco-friendly products of TurbineCrew are depicted by a leaf. The slogan "Smart Turbine for a Bright Future" is included to emphasize the identity of the AI-powered wind turbine.

TurbineCrew Company Status and History

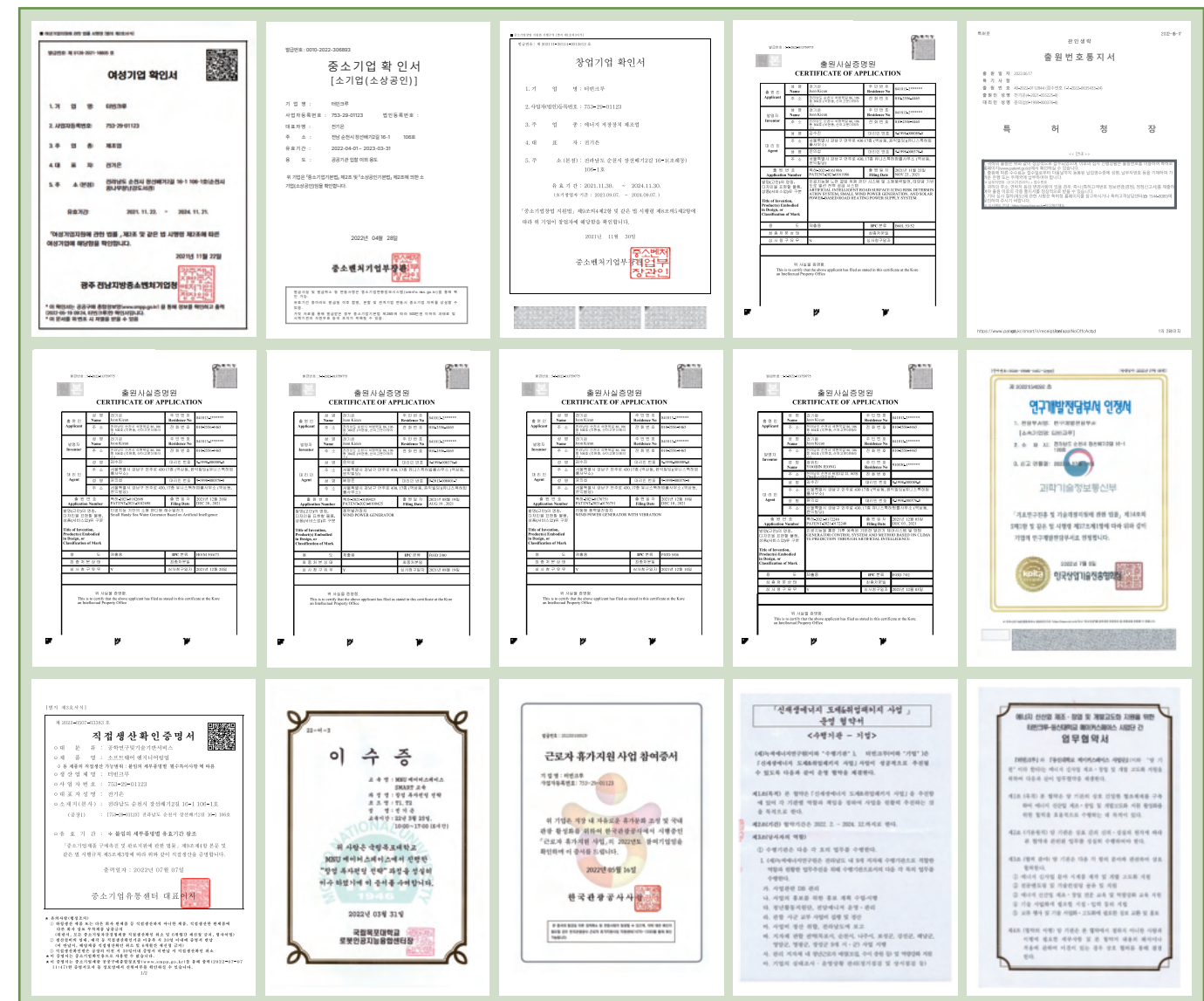
Company Name	: TurbineCrew Inc.
Establishment Date	: November 4, 2022 (registered)
Industry Type	: Manufacturing, Information and Communications
Number of Employees	: 9 people
Revenue	: 1.6 billion KRW (as of end of 2024)
Intellectual Property	: 34
Certification	: Venture company, corporate research institute, direct production certification
Capital	: 2.3 billion KRW (93% Gi Eun Jeon, 7% others)
Website	: www.turbinecrew.co.kr

History

- 
- A vertical timeline on the left side of the page, marked with green dots and green text for the dates. The timeline lists various achievements and milestones from February 2022 to April 2024. The text for each date is in a dark gray font, and the dates themselves are in a green font.
- | Date | Achievement |
|---------|---|
| 2022.02 | Selected as the best company for the 2021 Pre-Startup Package (Jeonnam) |
| 2022.11 | Middle East region Maker's Test 2022 Grand Prize
Jeonnam Innovation IR Excellence, National Public Innovation Center Data Center
Gwangju Jeonnam Inno-Polis IP Digital Representative Award and Excellent Company
12th Jeonnam Excellence Company Selected |
| 2023.04 | Gwangju AI Modeling Competition 1st, IT Grand Prize 6th |
| 2023.06 | Artificial Intelligence Python Education, Kaggle Competition Mentorship
IR Competition Excellence Award (Jeonnam Information Protection Technology Award)
U.S. Patent for System Setup, 200 Global Customers |
| 2023.11 | Smart Grid X Success, 4th Academic Paper, Kaggle Competition Test and Evaluation
AWS Summit Nexpo Participation, AWS Certification Success |
| 2023.12 | Passed Korea Energy Technology Institution, Suncheon CBL Grand Prize
AWS FTR Certification (Technology Certification), Certified Jeju Smart City
Energy Technology Grand Prize |
| 2024.03 | 2024 Forest Big Data Utilization Hackathon Bronze Medal |
| 2024.04 | Seed Investment Attraction |

Patents and Certifications

Types of Intellectual Property	Industry and Intellectual Property Name	Application Number(YYYY.MM.DD)	Rights Holder
Patent	Wind Power Generation Device	Registration 10-2552984 (2023.07.04)	Gi Eun Jeon
Patent	Artificial Intelligence-Based Road Surface Freezing Risk Judgment System And Small Wind Power Generation, Solar-Based Road Heating Power Supply System	Registration 10-2577711 (2023.09.07)	Gi Eun Jeon
Patent	Generator Control System and Method Based on Climate Prediction Through Artificial Intelligence	10-2021-0172248(2021.12.03)	Gi Eun Jeon
Patent	Vibration-Based Wind Power Generation Device	10-2021-0176751(2021.12.10)	Gi Eun Jeon
Patent	Artificial Intelligence-Based Small Handheld Seawater Power Generator	10-2021-0176751(2021.12.10)	Gi Eun Jeon
Patent	Artificial Intelligence-Based Smart Wind Power System and Control Method for Power Prediction	10-2022-0087962(2022.07.18)	Gi Eun Jeon
Patent	Wind Power Generation Device Equipped with Artificial Intelligence-Based Automatic Control Device	10-2022-0091657(2022.07.25)	Gi Eun Jeon
Patent	Wind Power Generation Prediction and Monitoring System	10-2023-0085156 (2023.06.30)	Turbine Crew Inc.
Patent	Energy Storage System for Small Wind Turbine Using Drone Waste Batteries	10-2023-0106876 (2023.08.16)	Turbine Crew Inc.
Patent	Small Wind Power Generation Device	10-2022-0176460 (2022.12.16)	Turbine Crew Inc.
P C T	Artificial Intelligence-Based Road Surface Freezing Risk Judgment System And Small Wind Power Generation, Solar-Based Road Heating	KR2022/013067(2022.08.31)	Turbine Crew Inc.
P C T	Wind Power Generation Device Equipped with Artificial Intelligence-Based Automatic Braking Device	KT2022/011325(2022.08.01)	Gi Eun Jeon
P C T	Generator Control System and Method Based on Climate Prediction Through Artificial Intelligence	KR2022/010852(2022.07.28)	Gi Eun Jeon



Business Sectors SERVICE

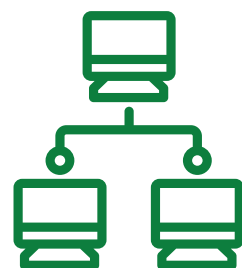
We are engaged in product development, software development, data processing, AI education, and research and development, covering key business areas

Turbine Crew is a comprehensive technology service company that provides innovative solutions for businesses. We excel in various fields, including software development, data processing, AI education, research and development, and design. We deliver customized solutions tailored to meet our clients' needs. Join us on a journey of innovation with Turbine Crew

01



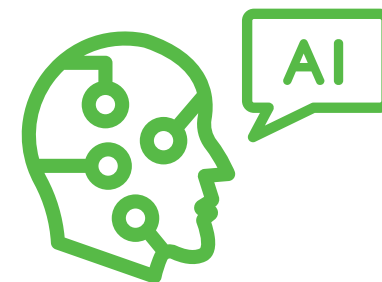
02



03



04



05



Product

제품개발

By implementing sustainable design, we practice environmental protection and social responsibility. We enhance design completeness through rapid prototyping and thorough testing. We ensure project success through close collaboration and smooth communication with clients, actively incorporating their feedback to achieve the best results.

Software

소프트웨어개발

Utilizing the latest technologies and expertise, we develop user-customized software. We create high-performance applications using various programming languages such as Python, Java, JavaScript, and C#, and modern frameworks like Django, React, and Spring. Additionally, we ensure efficient data management through relational databases like MySQL and PostgreSQL, as well as non-relational databases like MongoDB and Redis.

Data Processing

데이터가공

We collect and analyze data to process it into valuable information. We offer advanced data processing services to maximize the utilization of data assets. By integrating various data sources, we create consistent data sets and refine the data using the latest algorithms to ensure accuracy and consistency. Our real-time data processing capabilities enable quick and precise decision-making.

AI Education

AI 교육

Our AI education services help learners effectively understand and utilize artificial intelligence technologies, supporting their growth into future AI experts. We drive innovation in AI technology through better educational programs, and we work together to build your successful future.

R&D

연구개발

Our R&D business researches the latest technologies, including artificial intelligence, machine learning, big data, and the Internet of Things (IoT), to provide innovative solutions for our clients' businesses. We deliver tangible results through R&D services tailored to our clients' specific needs and goals. Our research team, composed of experts in each field, ensures a high level of technical proficiency and

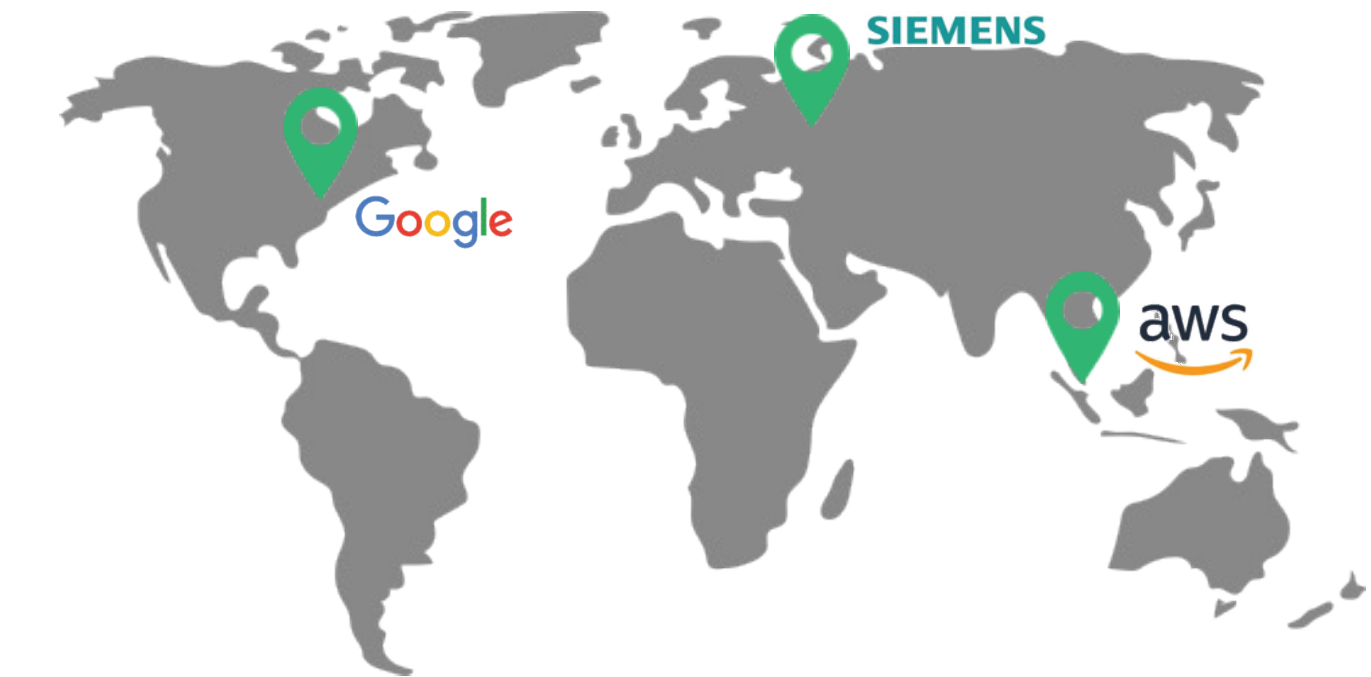
Building a Global Network

We are uploading our results to the AWS Technology Sharing Store and developing collaborative projects with global companies. Furthermore, we are working on a small VPP (Virtual Power Plant) collaboration with Siemens in Germany and establishing a global network for Docker and SageMaker solutions

Turbine Crew's Key Partners and Institutions



Turbine Crew Global Network



Information

2023

Sales	847,249,451
Operating Profit	200,509,931
Corporate Tax Adjusted Profit	207,647,126
Corporate Tax Expense	18,331,690
Net Profit for the Period	252,315,436
Total Assets	641,881,446
Current Liabilities	152,493,318
Non-current Liabilities	0
Capital	200,000,000
Total Capital	489,388,128

2022

Sales	118,000,000
Operating Profit	29,266,554
Corporate Tax Adjusted Profit	40,142,852
Corporate Tax Expense	3,070,160
Net Profit for the Period	37,072,692
Total Assets	117,380,391
Current Liabilities	30,307,699
Non-current Liabilities	0
Capital	50,000,000
Total Capital	87,072,692

제품개발 Product

Join us on our journey towards the future.
We will elevate your business to the next level with innovative technology
and sustainable energy solutions.

Smart Pole,Drone Battery Recycling, AI Turbine

Smart Pole

Smart Pole Solar is a system that integrates smart technology with poles equipped with solar panels. It tracks the position of the sun and adjusts the panels to the optimal angle to maximize solar energy production. This enhances energy efficiency, allows remote monitoring, and optimizes energy production.



Drone Battery Recycling

The method of recycling drone batteries primarily involves disassembling the used batteries and recycling reusable components, or applying regeneration technology to restore usable capacity. This helps conserve resources and contributes to environmental protection



AI Turbine

AI Turbine is an innovative technology system that optimizes the operation and maintenance of turbines used in power plants. This system utilizes various sensors and data collection devices to monitor the operational status and surrounding environment of the turbines in real-time. By analyzing this data, it derives optimal operating conditions. Additionally, it predicts and addresses potential failures in advance by analyzing the operational history of the turbines.



소프트웨어 개발 Software

We assist new business success with cutting-edge technology.
Together, we will open the future through sustainable solutions.

AI Prediction System, Drone Optimal Route System

AI Prediction System

AI Road Prediction System is an innovative technology designed considering the complexity of modern road and traffic infrastructure. This system utilizes the latest machine learning and deep learning technologies to analyze various data sources and predict road and traffic conditions. Firstly, the AI Road Prediction System collects data from various sources in real-time. This data can include CCTV footage, traffic cameras, vehicle sensor data, GPS information, and weather information. These diverse data sources play a crucial role in comprehensively understanding road and traffic conditions



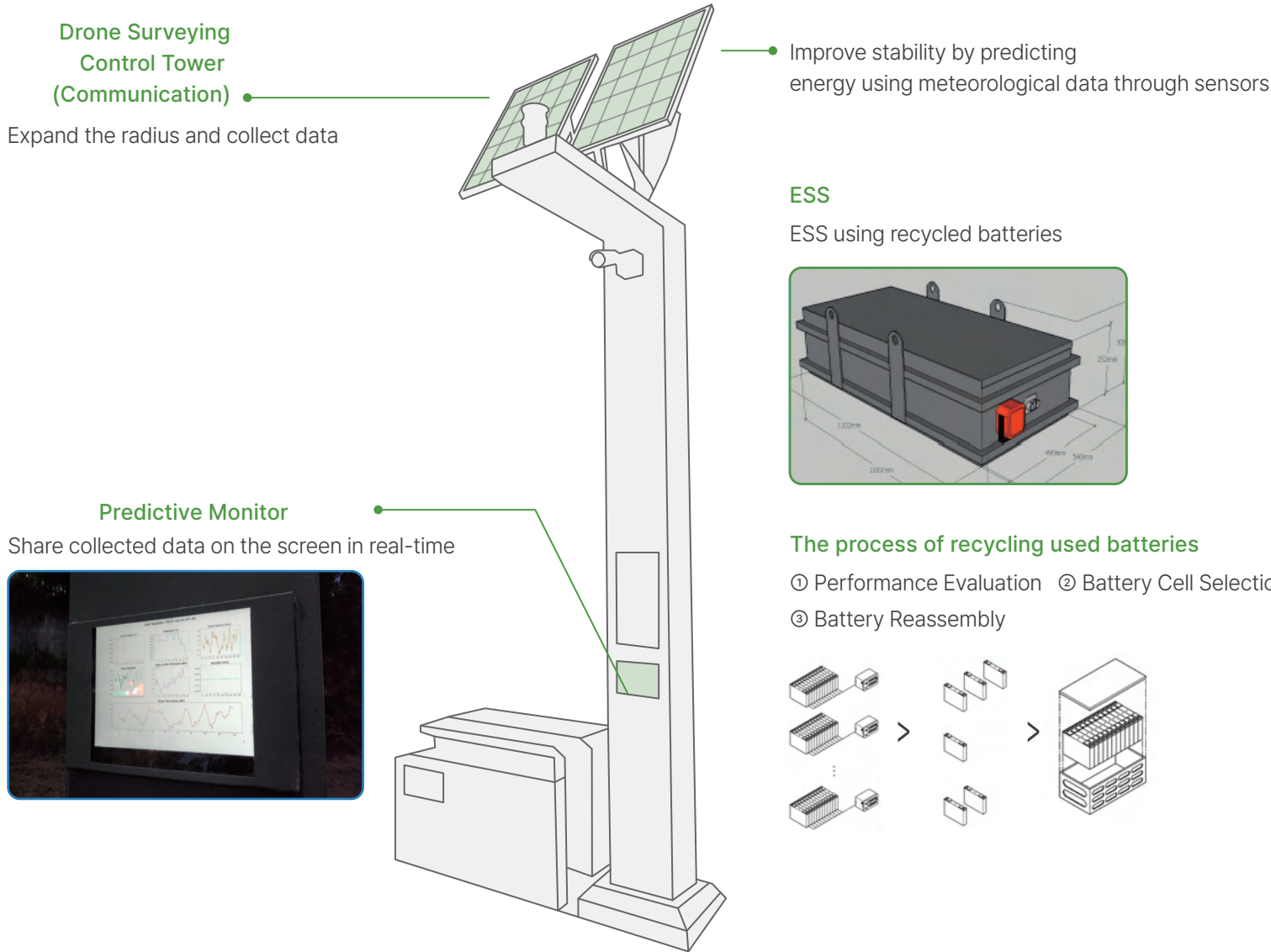
Drone Optimal Route System

The Drone Optimal Route System integrates sensors, cameras, GPS, and artificial intelligence to enable drones to perceive their environment in real-time, plan and navigate the optimal route to their destination. This technology encompasses four main functions: environment perception, route planning, route following, and reaching the destination. Drones use sensors such as cameras, radar, and lidar to understand the surrounding environment, and based on the collected data, they plan and set the optimal route. The drones then follow the planned route and, if necessary, move to the next destination or return to the base



스마트폴 Smart pole

Energy is stored in a recycled battery ESS through the smart pole for energy storage



Product-related certificates

- Test Report
- Detailed Test Specifications

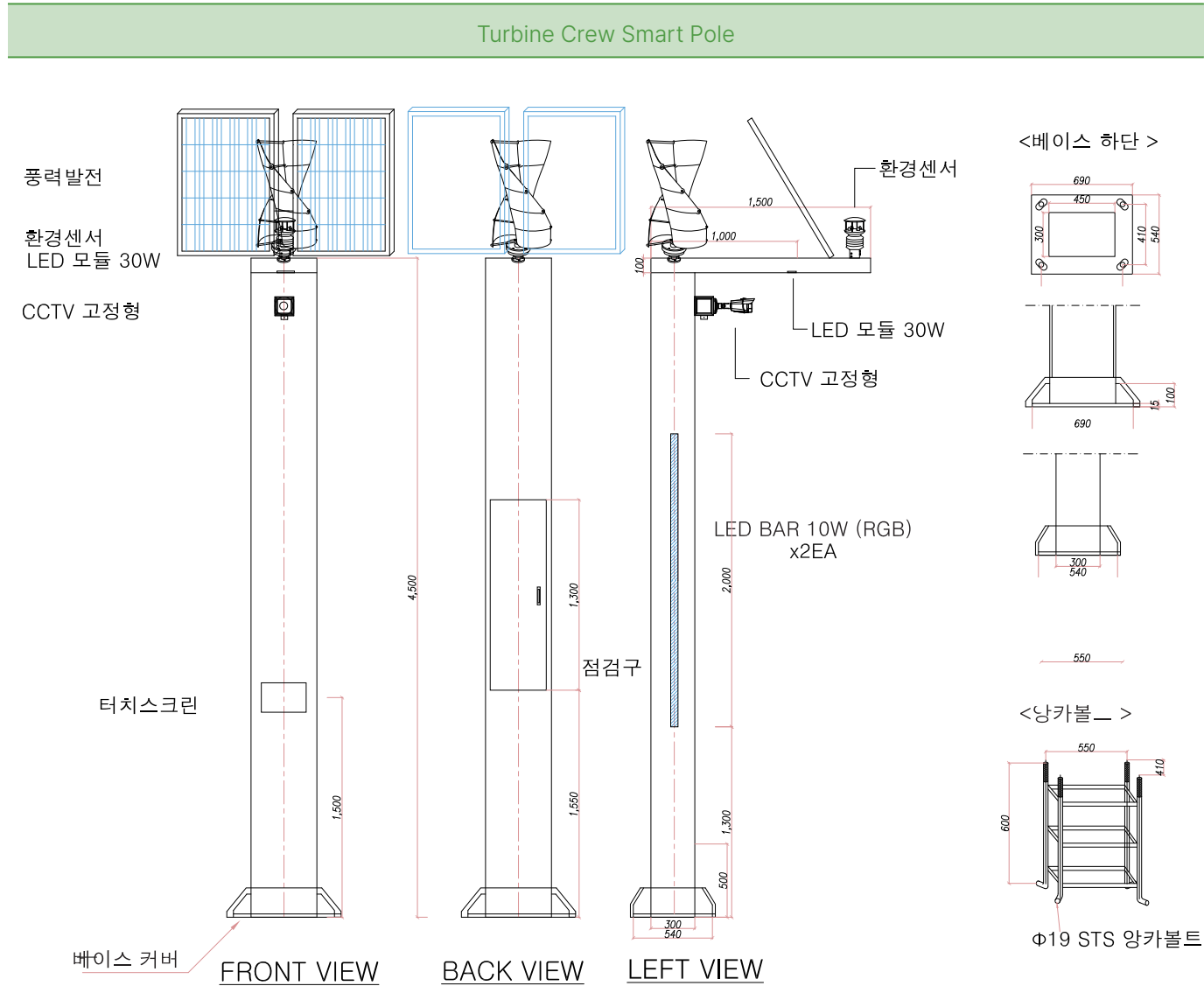


Target Market Size and Market Outloo

The global intelligent VPP (Virtual Power Plant) market is continuously growing, but small power producers are being marginalized in transactions. By connecting power plants to smart poles through the Smart Pole Star Topology System, we can facilitate exchanges with other regions and develop a detailed and precise VPP

Product Service Introduction

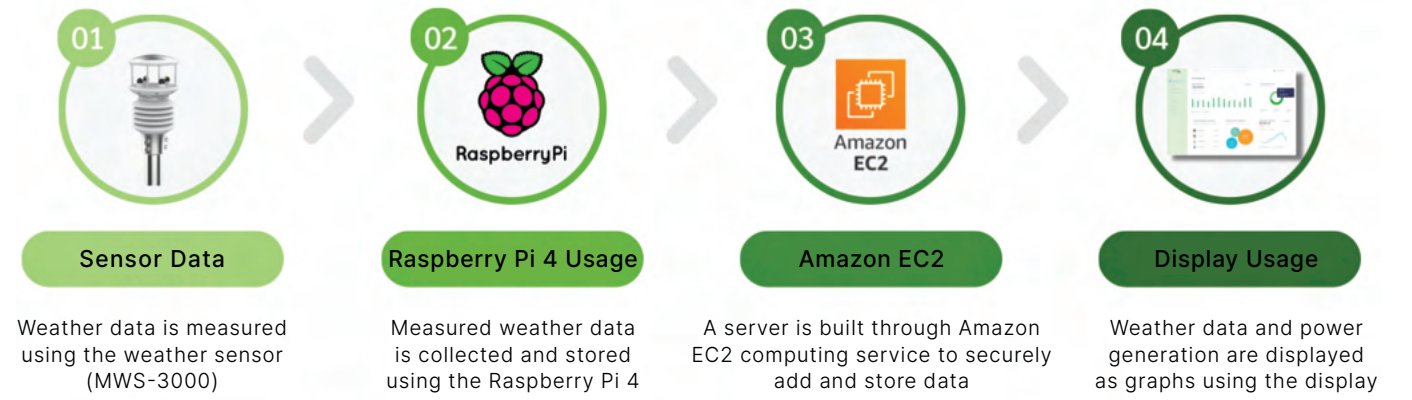
AI SaaS-based VPP, ultra-short-term prediction with CGAN-LSTM capable VPP, user-friendly for small-scale power producers, and power mobility network using V2X technology



스마트폴 Smart pole



Smartpole Process



Installation of Jangseong Army Sangmu Unit



Installation of Smart Farm in Goheung



Installation in Daesil Village, Naju



APPLICATION

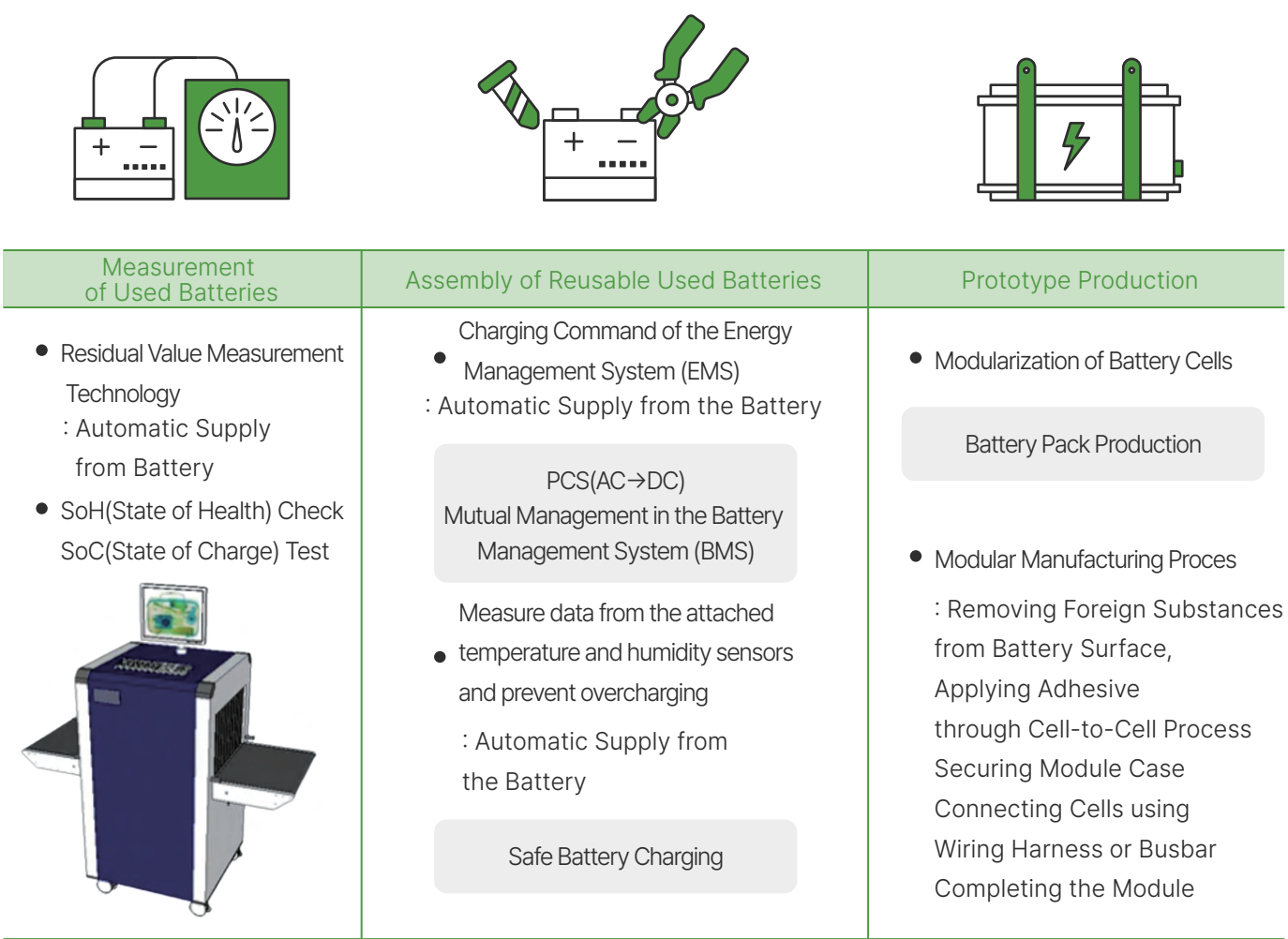


Drone Battery Recycling

We possess three key capabilities for enhancing drone battery recycling

After recycling the current batteries, the ultimate goal is to balance the fluctuating supply and demand of electricity and stabilize the inconsistent output by using ESS (Energy Storage System) to complement renewable energy and maintain and stabilize electricity quality. ESS uses an eco-friendly method of charging power and discharging energy when needed. Battery recycling technology is gradually being developed, but there is no ESS device for drone-specific battery recycling using small wind power, which is its distinguishing feature. When the Energy Management System (EMS) gives a charging command to the ESS, the Power Conversion System (PCS) receives the command to convert all AC to DC for charging. At this time, the PCS communicates with the Battery Management System (BMS) to command the battery to be charged, and the PCS converts the current supplied from the power plant to DC to supply to the battery. Conversely, if the stored electricity is to be discharged to the consumer, the discharge command process is performed in the order of EMS, PCS, and BMS

PROCESS



TORNADO LARGE

토네이도형(대형)

TORNADO LARGE

The design was inspired by the columns of the Temple of Athena. It is easy to assemble and designed to be slim, improving portability, making it suitable for use in various environments

The main body, rotating shaft, and blades that can be attached and detached from the sides of the rotating shaft. The upper cover contains an artificial intelligence control unit that controls the blades based on weather predictions

This is a new concept of wind power that utilizes the Venturi effect based on Bernoulli's principle, where the air entering from the bottom is amplified as the internal pipe narrows.

제품 스펙

- Size 50×110(cm)
- Rated Power: 6000W
- Voltage 12V/24V
- Rated Wind Speed: 11.5 m/s
- Safe Wind Speed 55 m/s



TORNADO SMALL

토네이도형(소형)



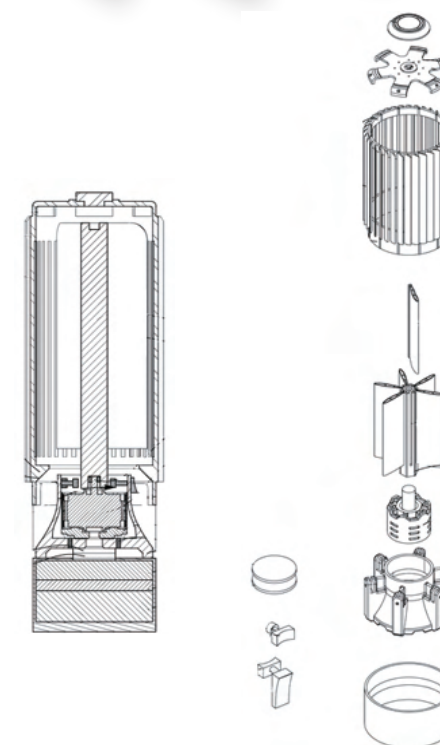
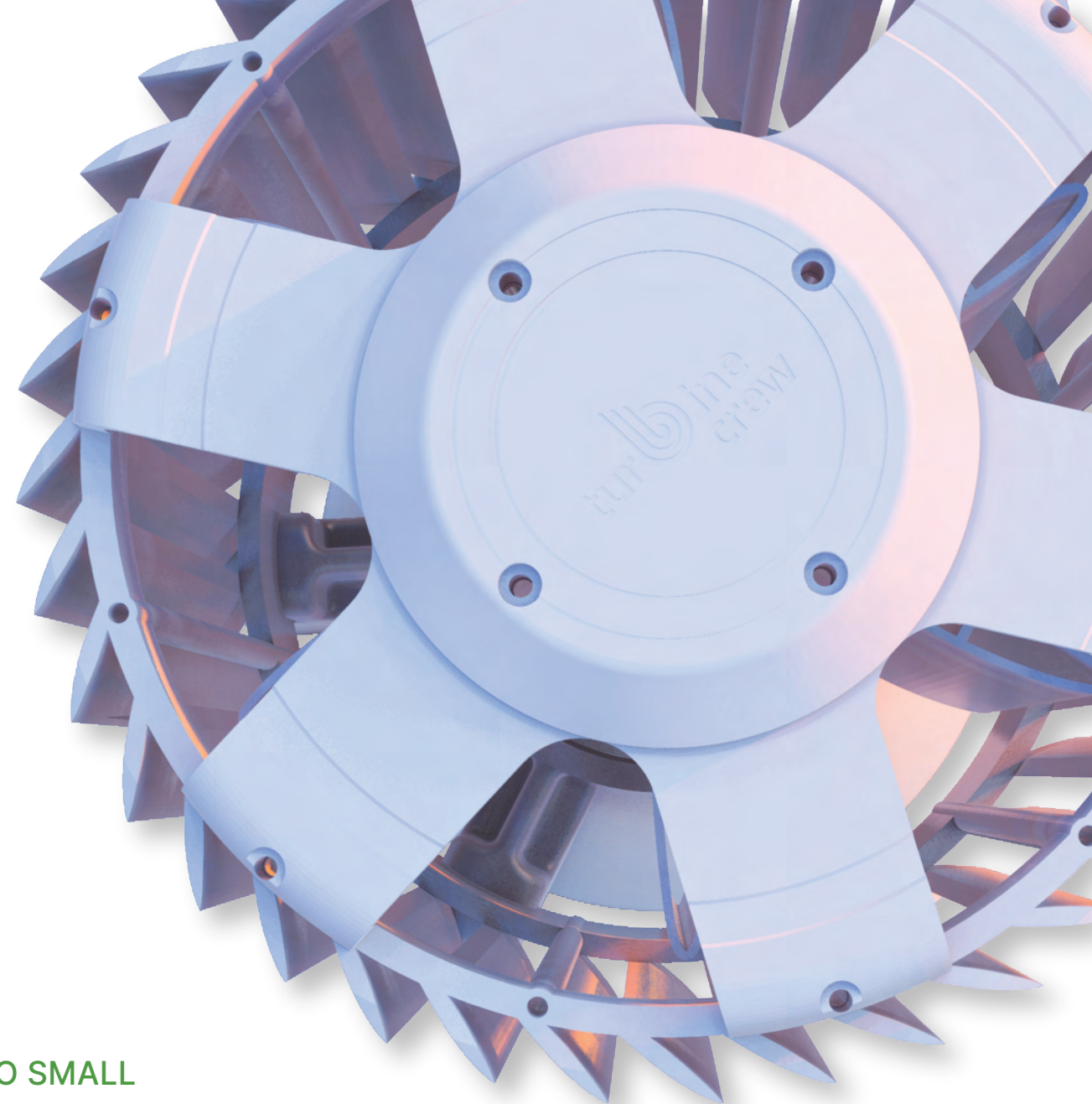
TORNADO SMALL

The wind is supplied at an angle to the rotating part to increase power generation efficiency. As the rotation of the rotating part accelerates, a real-time braking system is applied to the rotating part. Additionally, an artificial intelligence-based braking system is provided, offering preemptive braking capabilities based on weather conditions. This results in a wind power generation device equipped with advanced braking functions.

Compared to large tornado models, it is smaller and lighter, making it portable

SPEC

- SIZE 31×60(cm)
- 정격 와트수 100W
- Voltage 12V/24V



VIBRATION TYPE 진동형

VIBRATION TYPE

A typical wind power generation device is a device that converts wind energy into electrical energy. It generates electricity by rotating the blades of the wind power device with natural wind.

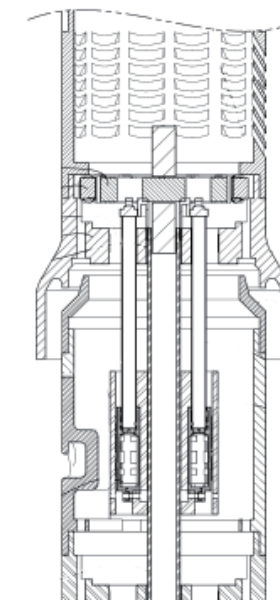
However, conventional wind power devices have large blades, which makes it difficult to install them in various environments due to spatial constraints. To address this, structures that are easy to use in urban areas by reducing the volume of the wind power devices are being developed. While existing wind power devices using vibration amplify vibrations by utilizing the vortex phenomenon of wind, they have structural complexities that make manufacturing difficult and are challenging to install or move to desired locations where strong winds are prevalent.

Additionally, the vibration-type wind power generation device can include a control unit that incorporates a first actuator. This actuator is coupled to the elastic part at the lower end of the vibrating part, and an internal rod extends upwards to connect with the stator. The control unit can move the coil part to be spaced apart from or adjacent to the rod according to the up-and-down movement of the rod.

The vibration-type wind power generation device has the advantage of being applicable in various environments, as the length of the vibrating part can be increased or shortened to the desired length by adding or removing vibrating tubes in the vibrating part, which is composed of single or multiple vibrating tubes.

제품 스펙

- 사이즈 18×135(cm)
- 정격 와트수 100W
- 전압 12V/24V



Turbine Crew Product Design



Clebin is the AI-driven small wind turbine brand of Turbine Crew, committed to sustainable renewable energy



Product Introduction

- This AI-driven small wind turbine can prevent damage caused by strong winds.
If the wind speed exceeds the set threshold, it autonomously controls the rotational speed of the rotor to reduce it.



Product Introduction

- The universal blade design for home and other uses makes it easily accessible to anyone.
By visualizing the essence of the product's function—wind and airflow—using curves, it is designed to become a landmark sculpture on your rooftop

APPLICATION

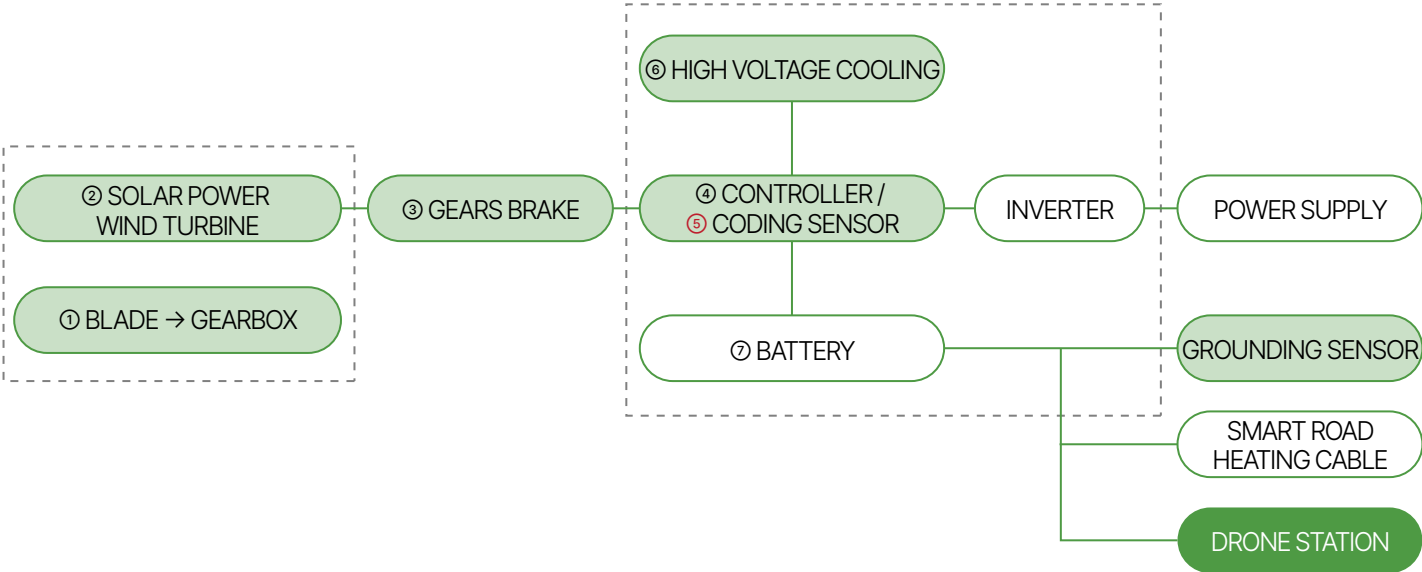


APPLICATION



AI Prediction System

This concerns a smart unmanned drone station and an electric vehicle charging system. Specifically, it involves the development of a smart unmanned drone station utilizing solar and small wind power generators and an electric vehicle charging system using wind power. The related patent, 10-2021-0161986 (2021.11.23), is for an AI-based road freezing risk judgment system and a small wind power and solar-powered road heating system.



Artificial Intelligence Dataset

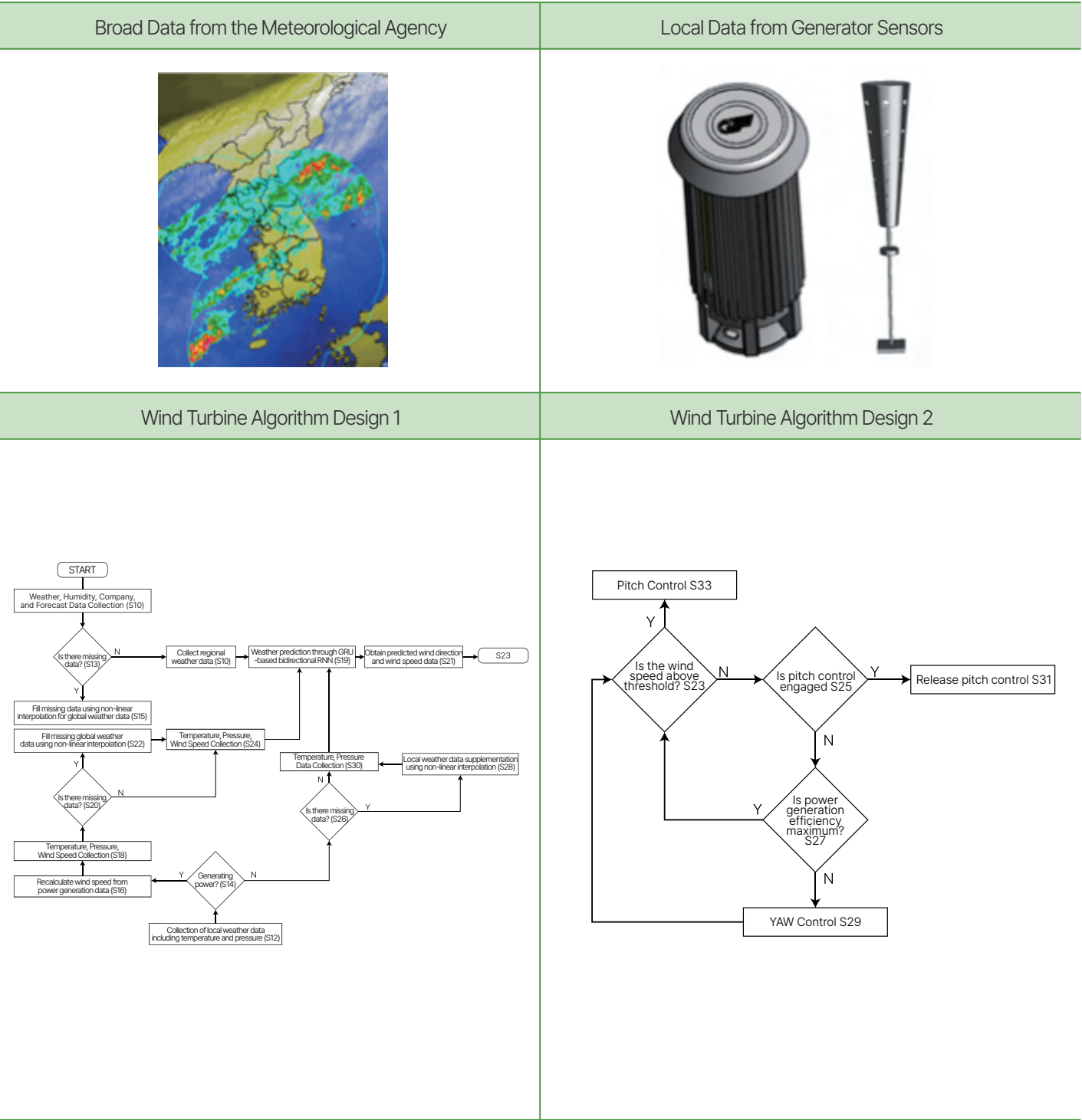
[35]:

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1 test_data = df2[train_size:]
2 test_data.head(50)
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[35]:

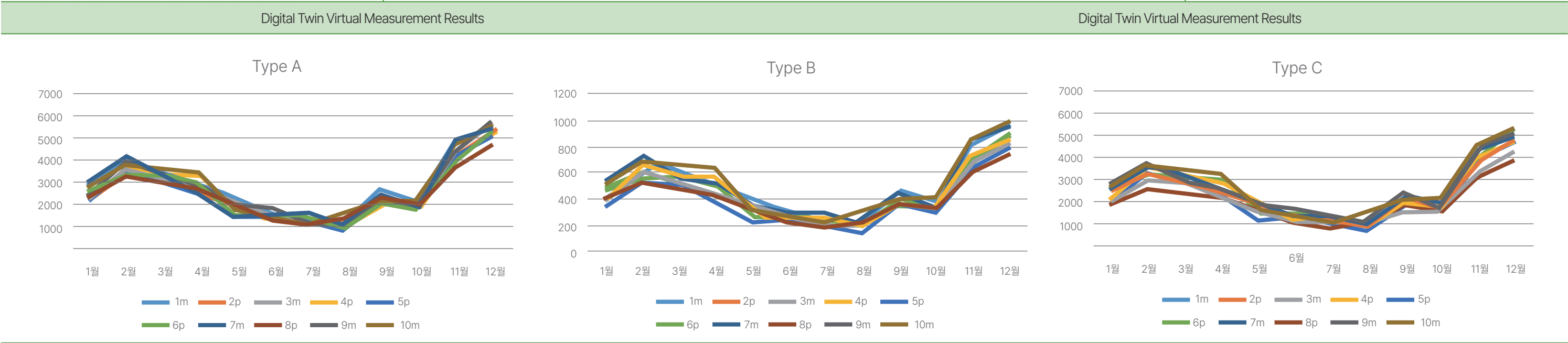
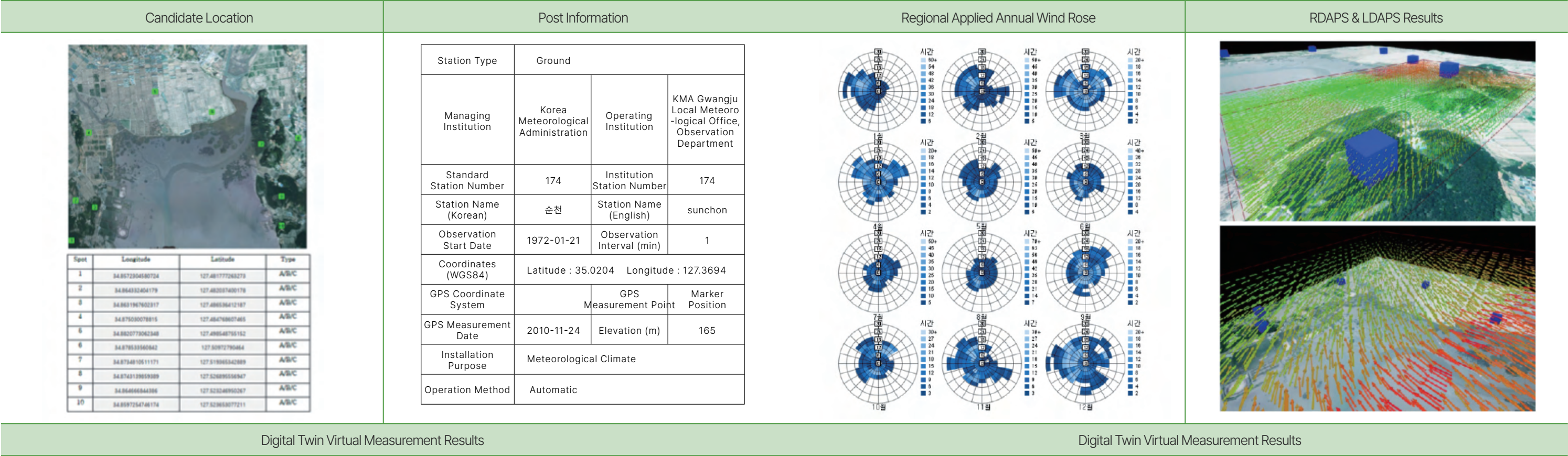
	일시	기온 (°C)	1분 강수량 (mm)	강수유무(유무)	풍향 (deg)	풍속 (m/s)	습도 (%)
4247966	2020-12-06 22:10	2.3	0.0	0.0	187.2	0.9	80.4
4247967	2020-12-06 22:11	2.3	0.0	0.0	157.2	1.1	74.7
4247968	2020-12-06 22:12	2.4	0.0	0.0	138.1	0.8	79.7
4247969	2020-12-06 22:13	2.6	0.0	0.0	129.4	0.6	74.4
4247970	2020-12-06 22:14	2.6	0.0	0.0	153.6	0.3	79.1
4247971	2020-12-06 22:15	2.4	0.0	0.0	190.4	0.2	79.0

By combining broad data from the meteorological agency with local data from the generator sensors, accurate and precise predictions are possible. Existing models that rely solely on meteorological agency data have reduced accuracy in locations far from observation stations. Therefore, local data is measured using temperature and humidity sensors attached to the generator to complement the broad data from the meteorological agency. This is an AI-based climate prediction system designed to improve wind turbine efficiency and stability, as well as a generator control system based on climate prediction results



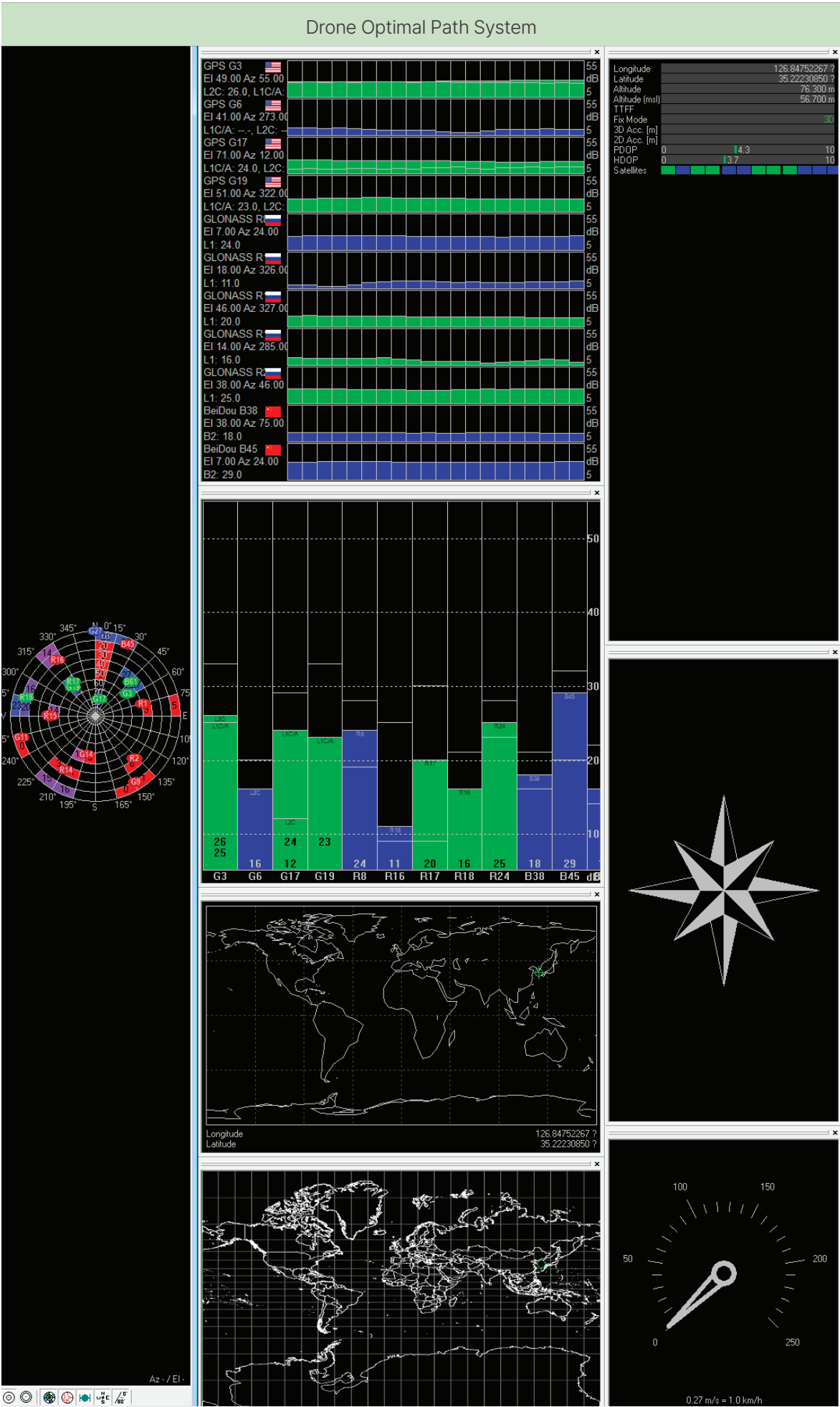
Digital Twin Virtual Simulation

We have developed an artificial intelligence-based smart wind power system controller capable of power prediction. Using current weather data such as temperature, humidity, wind direction, and wind speed, we have built an RNN-based deep learning model that predicts the environment in a local area. By integrating regional weather data from the meteorological agency and national weather data measured by wind turbines, we generate artificial intelligence input data. Missing meteorological data from the weather agency is restored through non-linear interpolation. Based on this technology, to protect the wind turbines, it is necessary to build an accurate wind speed prediction system at the location where the wind turbines are installed, in order to prevent damage from winds above the threshold wind speed. To achieve this, a digital twin model was created to predict power generation through virtual simulation.



Drone Optimal Path System

The Drone Optimal Path System integrates sensors, cameras, GPS, and artificial intelligence to enable drones to recognize the environment in real-time, plan a route to the destination, and move along that path. This technology is achieved through four steps: environmental recognition, path planning, path following, and destination reaching. The drone uses sensors like cameras, radars, and LiDAR to detect the surrounding environment and, based on the collected data, plans and sets the optimal route. The drone then moves along the set path and, if necessary, will either proceed to the next destination or return to the base.



Study of VPP ultra-short-term power prediction and regulation using DER connections

DER 연결을 활용한 VPP 초단기 전력 예측 및 조절 연구

Abstract

This study presents a new approach to enhance the ultra-short-term power prediction and control capabilities of a Virtual Power Plant (VPP) by utilizing the integration of Distributed Energy Resources (DER). The integration of DER plays a crucial role in increasing the flexibility and reliability of power systems and has become a key element in the operation of VPPs. In this paper, a combination of machine learning techniques and optimization algorithms is used to develop an efficient management strategy for VPPs, considering the dynamic characteristics of DER and the fluctuating energy demand. The proposed model was validated based on real data and showed significant improvements in prediction accuracy and system stability compared to existing methodologies. The results of this study will help VPP operators actively respond to fluctuations in the power grid and enable the efficient integration of renewable energy resources. This research also provides important insights for transitioning toward improving the sustainability and economic viability of power systems.

Introduction

The increase in renewable energy resources has led to the introduction of Distributed Energy Resources (DER), which is changing the structure of power systems. These changes present new challenges in the operation of power systems, and the variability and prediction uncertainty of renewable energy have become significant issues in managing the stability and efficiency of the power grid. To address these challenges, the concept of Virtual Power Plants (VPP) has been introduced. A VPP contributes to ensuring a continuous and stable energy supply to the power grid by coordinating multiple distributed energy resources within a single operating system.

The main objective of this study is to improve the ultra-short-term power prediction and control capabilities of VPPs by utilizing DER integration. Accurate short-term predictions are essential for VPP operations, as they enable effective management of the variability of renewable energy supply and the uncertainty of demand. This study aims to develop a more precise and reliable power prediction model by applying artificial intelligence techniques and machine learning algorithms, considering the dynamic characteristics of DER.

This research targets three key contributions: the optimization of VPP operations, the improvement of power system stability, and the efficient integration of renewable energy. Additionally, this study is expected to provide important insights that will enhance the competitiveness of VPPs in the power market and accelerate the transition to a sustainable energy system.

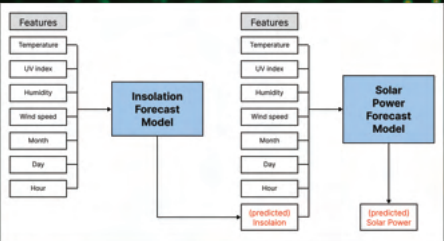
Main Body

2.1 Research Methodology

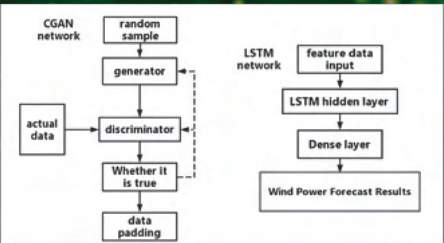
The goal of this study is to improve the ultra-short-term power prediction and control capabilities of Virtual Power Plants (VPP) by integrating Distributed Energy Resources (DER). To achieve this, the Long Short-Term Memory (LSTM) neural network was used, and the effectiveness of LSTM has already been demonstrated in previous studies on time-series data (Hochreiter & Schmidhuber, 1997).

The solar LSTM model applied in this study consists of an input layer, two hidden LSTM layers, and an output layer. Each LSTM layer contains 50 units, and dropout techniques were applied to prevent overfitting. The Adam optimization algorithm was used during the training process, and the loss function applied was Mean Squared Error (MSE).

To predict wind power generation, this study utilizes Conditional Generative Adversarial Network (CGAN) and Long Short-Term Memory (LSTM). By training on collected weather data, the generator of CGAN generates weather data with corrected missing values and outliers, and the LSTM performs short-term power prediction based on this corrected weather data. LSTM addresses the long-term dependency problem and reflects temporal dependencies well, making it possible to expect more accurate power generation predictions. Furthermore, using CGAN ensures stable power generation predictions, even in the case of temporary anomalies in the collection devices.



태양광 발전량 예측 프로세스 Solar Power Prediction Process



풍력 발전량 예측 프로세스 Wind Power Prediction Process

2.2 Data Analysis and Results

The data analysis in this study was based on the data provided by the "Global Energy Forecasting Competition 2014" and focused particularly on solar and wind power generation data (Hong et al., 2016). This dataset includes detailed power generation information on an hourly, daily, and monthly basis, providing an ideal environment for the development and verification of ultra-short-term prediction models.

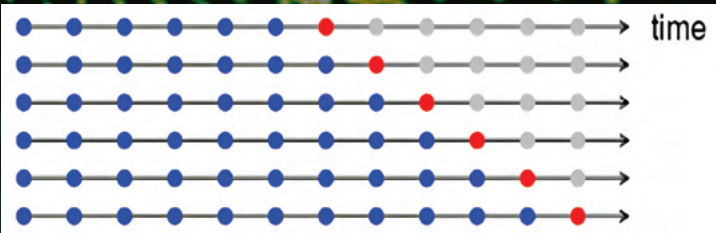
2.2.1 Data Processing and Preprocessing

In the data processing process, outlier removal and missing value handling were first performed to improve the quality of the data. Then, data normalization was carried out to enhance the learning efficiency of the model. These preprocessing steps directly impact the prediction accuracy of the LSTM model.

2.2.2 Evaluation of Prediction Model Performance

The performance of the model was evaluated using the Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) metrics. These metrics quantitatively show how well the model matches the actual data. In this study, the LSTM model achieved an average MAE of 2.8% and an average RMSE of 4.1% for solar power generation prediction, while for wind power generation prediction, the MAE was 3.6% and the RMSE was 4.8%. This indicates that the LSTM model achieved higher accuracy compared to existing time-series prediction models.

The table comparing "actual vs predicted solar and wind power generation" visually shows the prediction performance of the LSTM model. Particularly, in wind power generation prediction, the difference between the actual and predicted values was very small, demonstrating that the model accurately captures the variability of wind power. The solar power generation prediction also successfully anticipated the increase in generation during the early morning hours, providing accurate information necessary for VPP operations.



시계열 교차 검증 기법 Time Series Cross-Validation

TIME	Solar Power Generation (Actual)	Solar Power Generation (Predicted)	Wind Power Generation(Actual)	Wind Power Generation (Predicted)
10:00	151Wh	146Wh	401Wh	392Wh
12:00	198Wh	194Wh	348Wh	343Wh
14:00	177Wh	175Wh	239Wh	235Wh
16:00	83Wh	78Wh	277Wh	274Wh

Comparison of Actual vs Predicted Solar and Wind Power Generation Data

2.2.3 Analysis of Prediction Results

These results confirm that the LSTM-based ultra-short-term power prediction model has the potential to contribute to the efficiency of VPP operations and the optimized utilization of renewable energy resources. Furthermore, this study further expands the applicability of AI technologies for enhancing the stability and sustainability of power systems.

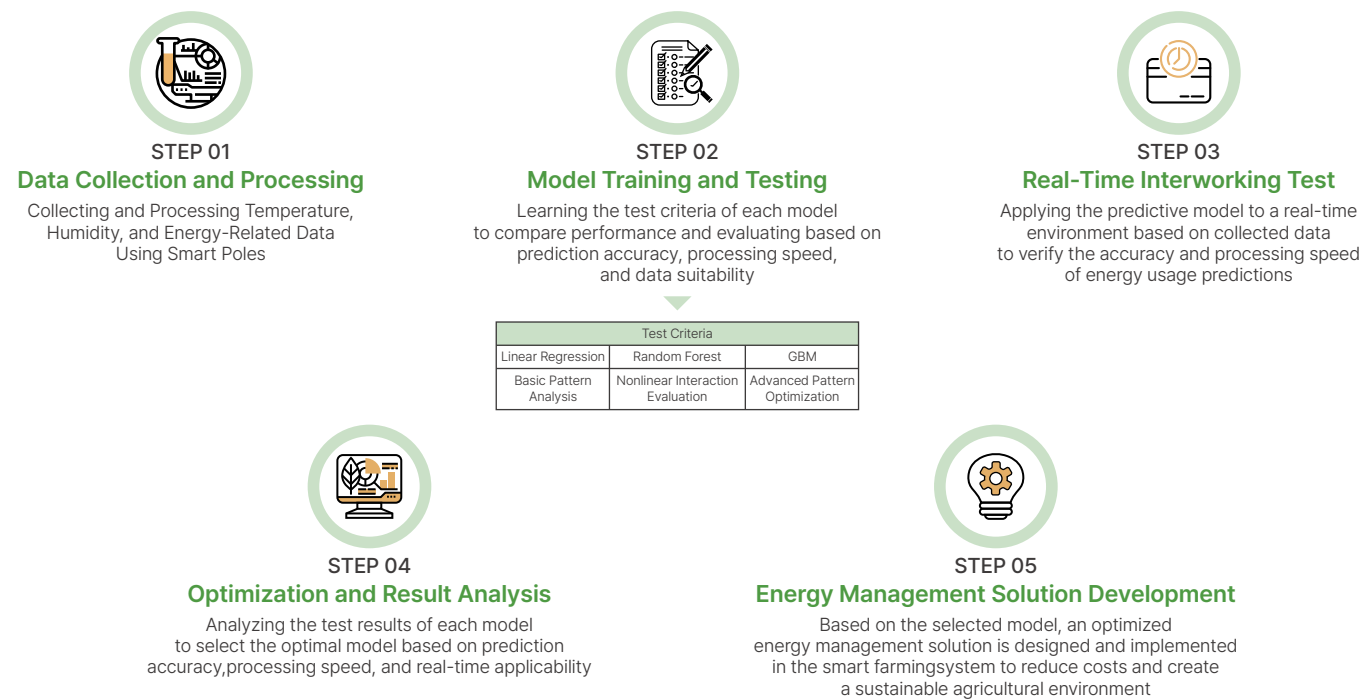
Conclusion

Through these results, it can be confirmed that the LSTM-based ultra-short-term power prediction model has the potential to contribute to the efficiency of VPP operations and the optimized utilization of renewable energy resources. Furthermore, this study further expands the applicability of AI technologies for enhancing the stability and sustainability of power systems.

TlatFarm

Development of an Agriculture Platform Based on Smart Poles and Smart Drones for Enhancing Agricultural Productivity and Optimizing Energy Usage

Establishment of an Energy Management Prediction Model

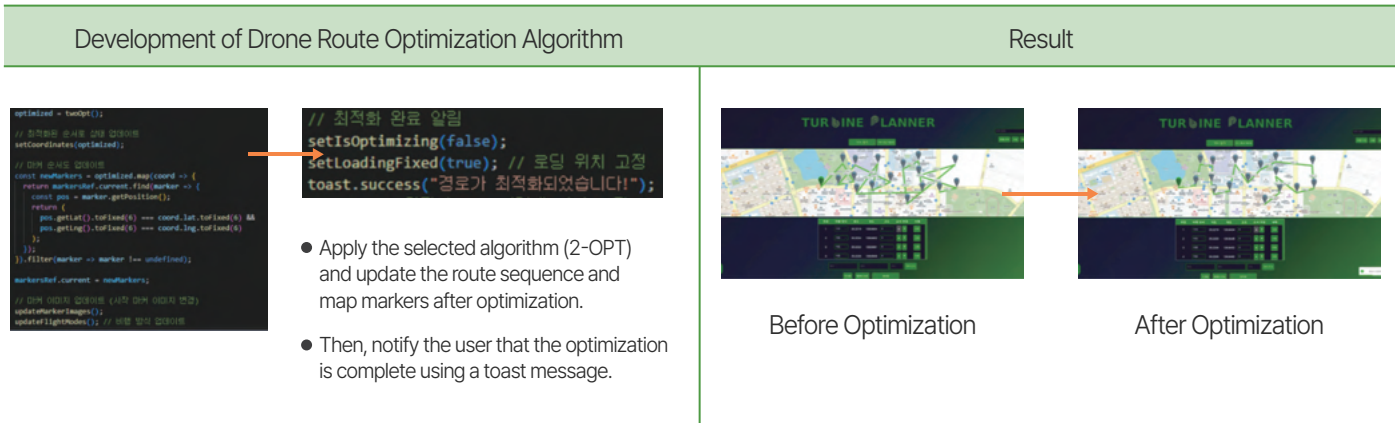
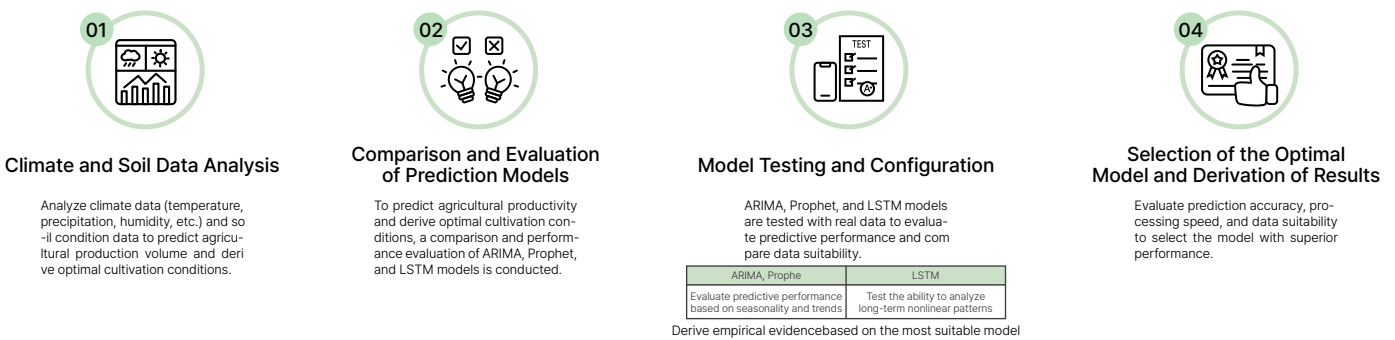


Data Collection Status	Data Collection Plan
- Weather sensor data is collected in real time (3 months) - Environmental data set currently being collected - Data on time, wind speed, wind direction, atmospheric pressure, precipitation, and power generation (approximately 72,745 records in .csv format)	- Power data is scheduled to be collected in real time - Measure stored power through BMS after wind and solar power generation. - Planned power data set for collection - Data on time, voltage, current, SOC, maximum cell voltage, minimum cell voltage, maximum temperature, and minimum temperature (15 records per hour, CSV file)

- ▶ Analyze energy consumption patterns in real time and improve the efficiency of energy resource utilization through an automated energy management solution
- ▶ Propose economically and environmentally friendly operation plans based on data generated from smart poles (renewable energy resources)

Development of an Agricultural Productivity Prediction Model

Model	Time Complexity	Advantages	Disadvantages	Example of Model Application
ARIMA (Autoregressive Integrated Moving Average)	$O(n) \sim O(n^2)$	Possible to predict seasonal patterns of agricultural production volume and energy consumption volume	Does not work well outside simple patterns	Predict production volume trends and seasonal variations based on past data
Prophet (Facebook Prophet)	$O(n)$	Can easily handle seasonal and repetitive patterns	Difficult to customize as it is an optimized model for specific environments	
LSTM (Long Short-Term Memory)	$O(n) \sim O(n^2)$ per epoch	Predict crop growth cycles or energy consumption patterns based on long-term data	The more data, the longer the learning time	Predict agricultural growth cycles over the long term to optimize productivity



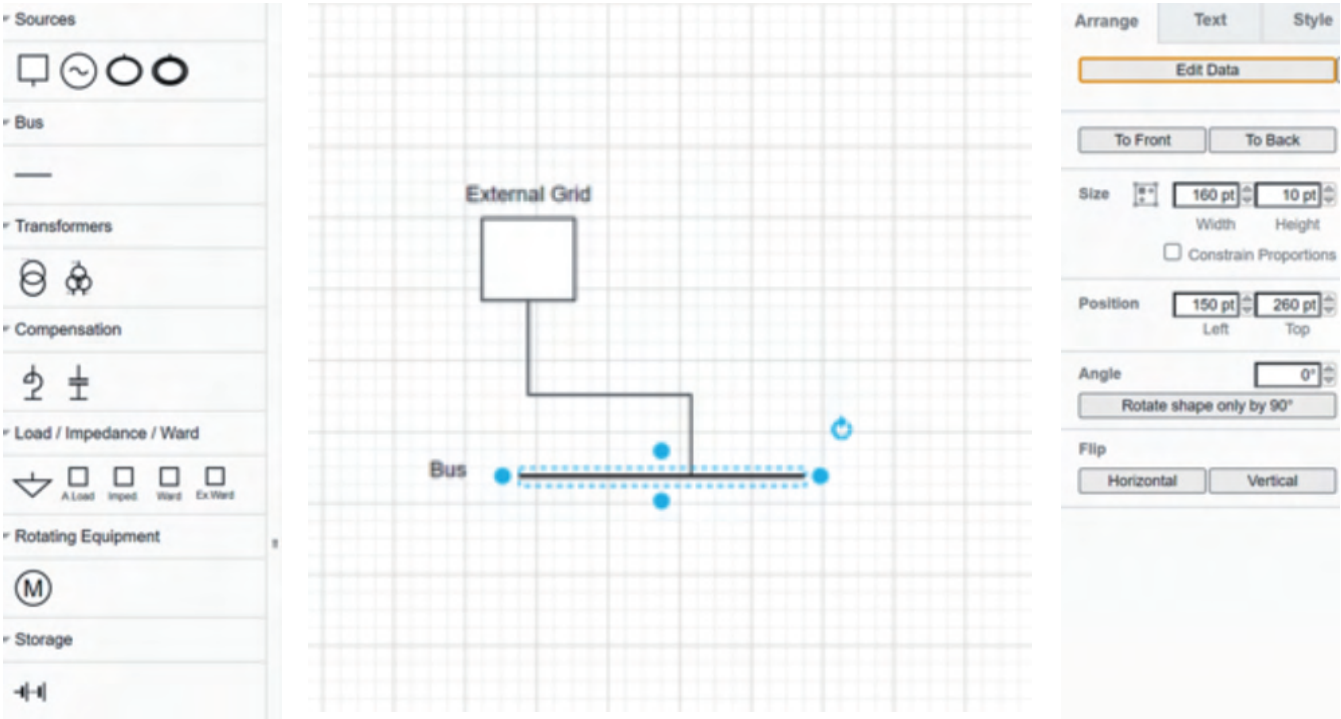
- ▶ Increasing farm operational efficiency through energy savings and cost reduction.

TBPASS

Power System Simulation Program

Generator Modeling

Conventional Generators Modeling	- Mainly used in large thermal power plants, nuclear power plants, and hydroelectric power plants. - IEEE standard generator models can be applied (IEEE Type 1~6 Excitation System). - Includes modeling of rotor dynamics (inertia), reactive power control, governor response, etc.
Renewable Energy Generators Modeling	- Photovoltaic Generator (PV System) Modeling - Wind Turbine Generator (WTG System) Modeling - Hybrid Generator Model Integrated with Energy Storage System (ESS)
Generator Control System Modeling	- Governor System (Speed Regulator) → Controls generator output power - Excitation System (Excitation Control) → Regulates voltage and compensates reactive power - PSS (Power System Stabilizer) → Enhances system stability



Short circuit analysis

Fault: ☒ 3ph ☐ 2ph ☐ 1ph

Case: ☒ max ☐ min

Voltage tolerance in low voltage grids: ☐ 6% ☒ 10%

Define option for meshing: ☒ auto ☐ radial ☐ meshed

Failure clearing time in seconds (only relevant for ith): 1

Fault resistance in Ohm: 0

Fault reactance in Ohm: 0

Inverse should be used instead of LU factorization: ☒ True ☐ False

Cancel

Calculate

Load flow analysis

Frequency: ☒ 50Hz ☐ 60 Hz

Algorithm: ☒ nr ☐ iwamoto_nr ☐ bfw ☐ gs ☐ fdbx ☐ fdxb

Calculate voltage angles: ☒ auto ☐ true ☐ false

Initialization: ☒ auto ☐ flat ☐ dc

Cancel

Calculate

Short Circuit Analysis

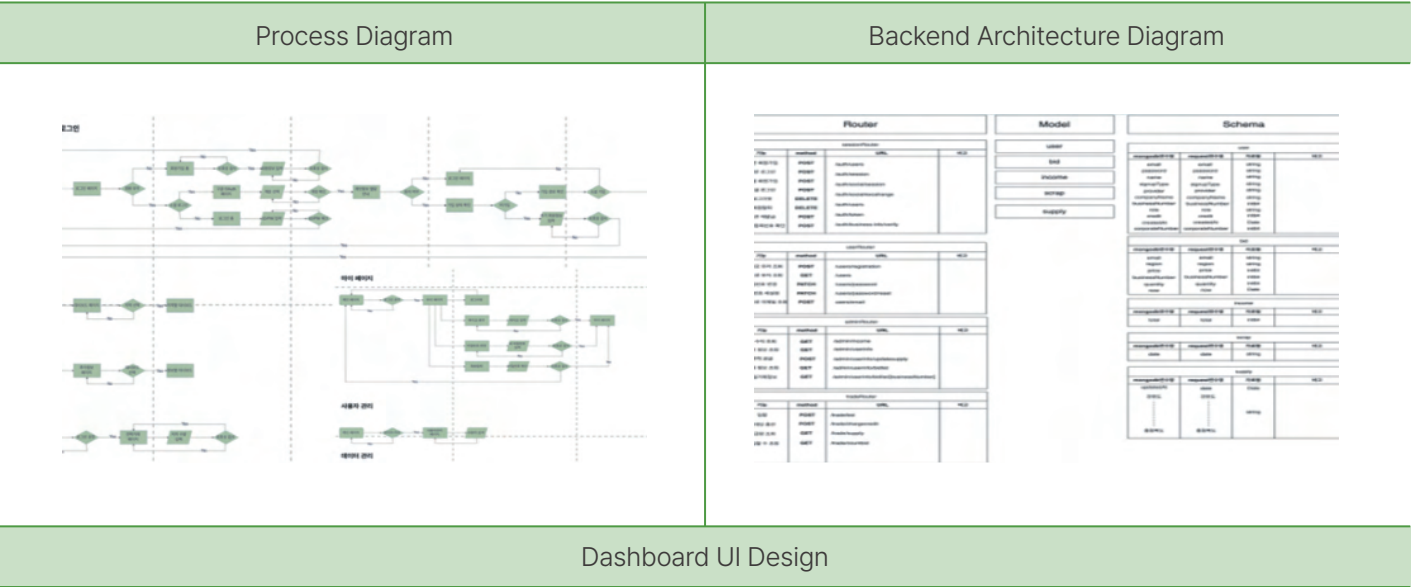
Short Circuit Current Calculation	Protection Device (Breaker, Relay) Settings
Calculates the short circuit current that flows during a fault event to evaluate whether the equipment can withstand it.	- Adjusts the settings of breakers and protective relays. - Optimizes the response speed to power grid faults through appropriate protection device settings.
Power Grid Stability Assessment	Equipment Capacity Review
- Analyzes voltage recovery and system restoration speed after a fault event. - Derives improvement measures to enhance fault tolerance during power grid operation.	- Evaluates whether transformers, generators, and transmission lines can withstand short circuit currents. - If the fault current exceeds the allowable range of the equipment, replacement is required.

VPP

Frontend VPP Development

Dashboard Development

- Visualization of
real-time power generation
and consumption
(using charts and graphs)
- Analysis of P2P
power transaction history
& price fluctuations
- AI-based power demand
and supply forecasting
(including optimal transaction
recommendation function)



Power Exchange Establishment

- The conventional centralized power market operates by having large-scale power plants (such as thermal and nuclear power) generate electricity and sell it through a power exchange.
- VPP-based power exchanges support a P2P power market where distributed power sources (such as solar prosumers) can trade electricity directly.
- The power exchange acts as an intermediary, performing functions such as real-time price determination, transaction settlement, and market stability management.

Category	Conventional Power Exchange (Centralized)	VPP-Based Power Exchange (Decentralized)
Market Structure	Power companies (large-scale power plants) → Intermediary → Consumers	Direct transactions between prosumers (P2P)
Price Determination	Power plants → Market → Fixed prices	Real-time supply-demand-based variable pricing
Transaction Method	Centralized auction-based trading	Smart contract-enabled transactions
Flexibility	Limited (dependent on large power plants)	Utilizes distributed resources (DER, ESS, V2G, etc.)
Data Management	Managed by power companies and market operators	Transparent transactions based on blockchain



Development of a Simulation Program for LiDAR Performance Optimization

Data Processing

Raw Material Reference Data

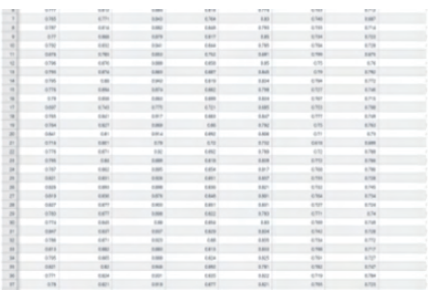
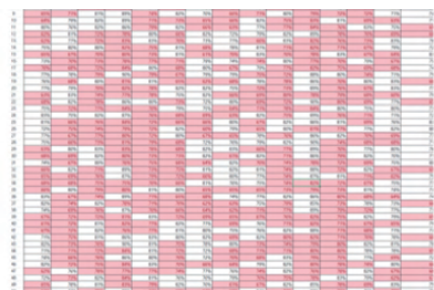
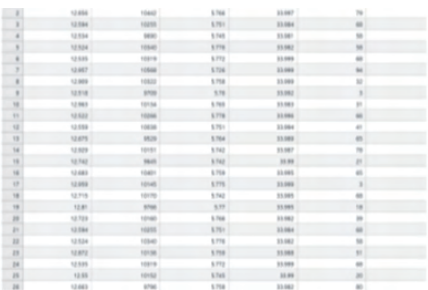
It is difficult to distinguish between good and defective products depending on the lens raw material.

After Processing

The individual lens raw material data is augmented by approximately 70 times, and a 'classification' column is generated for categorization.

G1, G2, G3, G4... data is bundled into a single file

CSV file for G1 data



Reference file for lens measurement classification data

CSV file of lens measurement data

Lens Measurement Reference Data

It is difficult to distinguish between good and defective products based on lens measurement values.

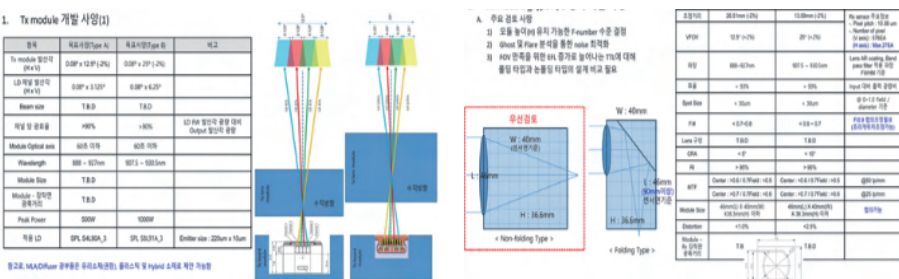
After Processing

Classification of good and defective products based on lens measurement threshold values.

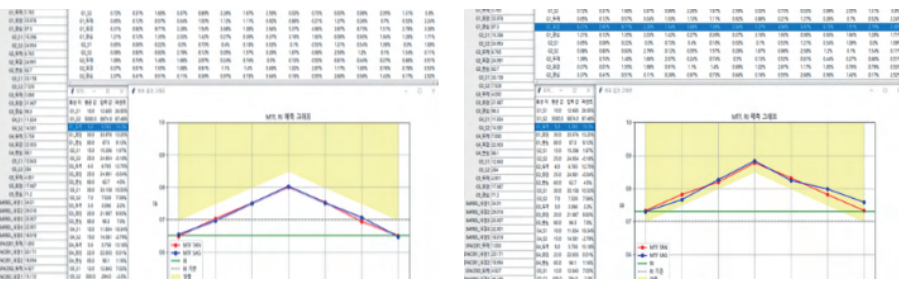
Simulation Algorithm

- To secure an annual mass production volume of 1K units, the standardization of LiDAR optical axis alignment is required. Therefore, an AI solution has been introduced to enable the development of technology capable of assembling up to 100K units at full production capacity.

Customer-Requested Specifications After Completing Scanning LiDAR POC



LiDAR Lens Performance Prediction Simulation



Deriving Conclusions Through Correlation Analysis of BARREL Raw Materials



3D Prediction System for Optical Axis Alignment of the Introduced BM

