Fire detection system proposal

RXO Co., Ltd.

Flame Watch Slim

RXO Fine-Tone Detection Alarm System

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RXO Co., Ltd.

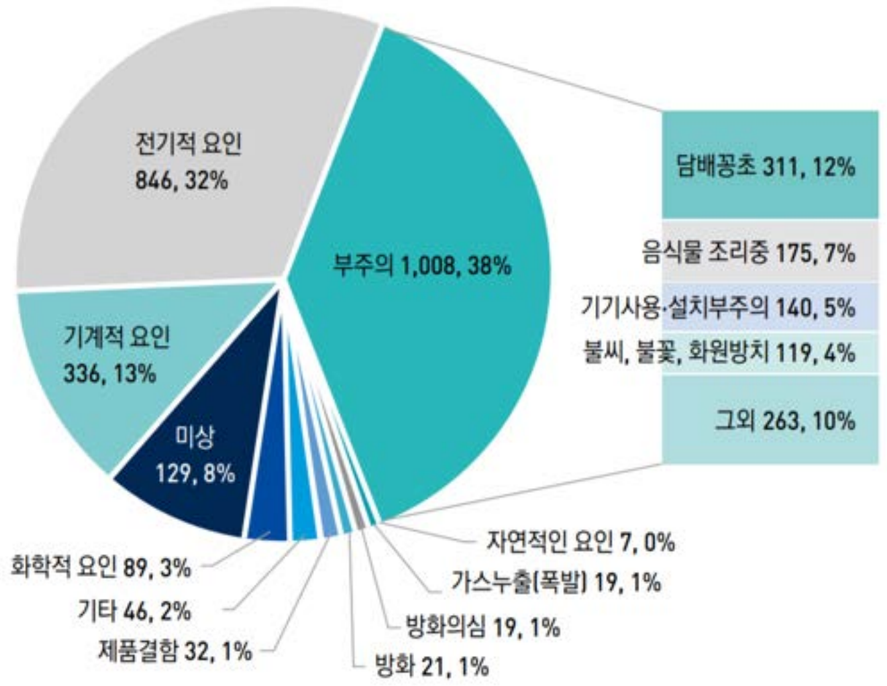
TECHNOLOGY DEVELOPMENT BACKGROUND

Necessity of the product

Statistics on the cause of the topic

RXO Co., Ltd.

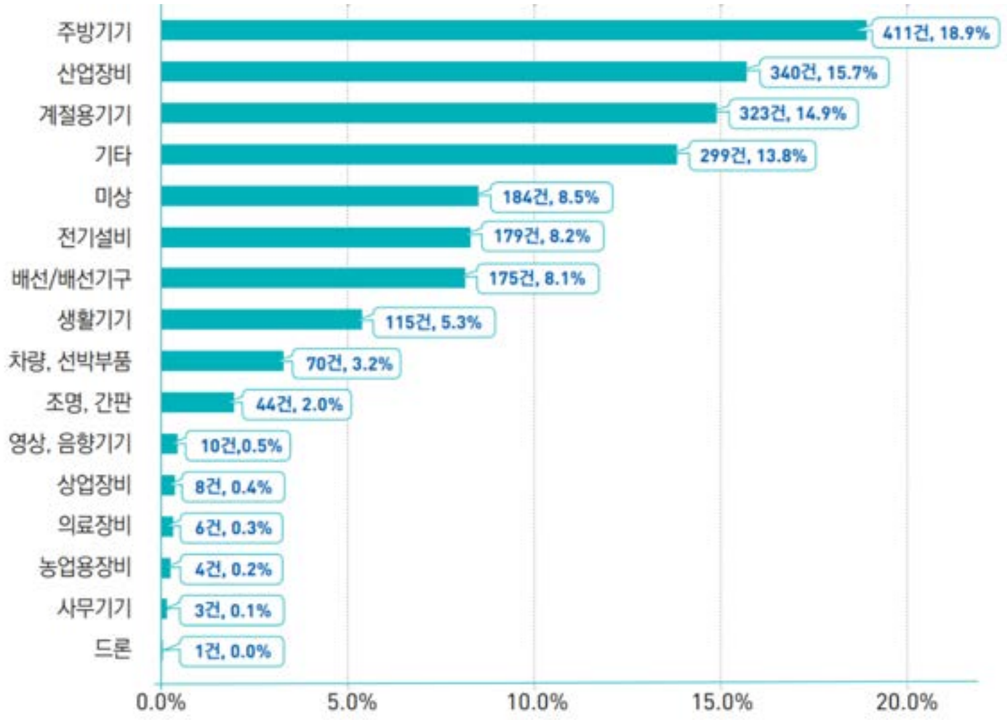
Cause of topic arising



The most common cause of fire was carelessness, accounting for 1,008 cases (38%). Next were electrical factors (846 cases, 32%) and mechanical factors (336 cases, 13%).

"Electrical and mechanical factors account for 45% of fires"

Equipment and electronic device fire occurrence rate



Kitchen appliances accounted for 411 cases (18.9%), industrial equipment accounted for 340 cases (15.9%), seasonal equipment accounted for 14.9%, and electrical equipment accounted for 179 cases (8.2%).

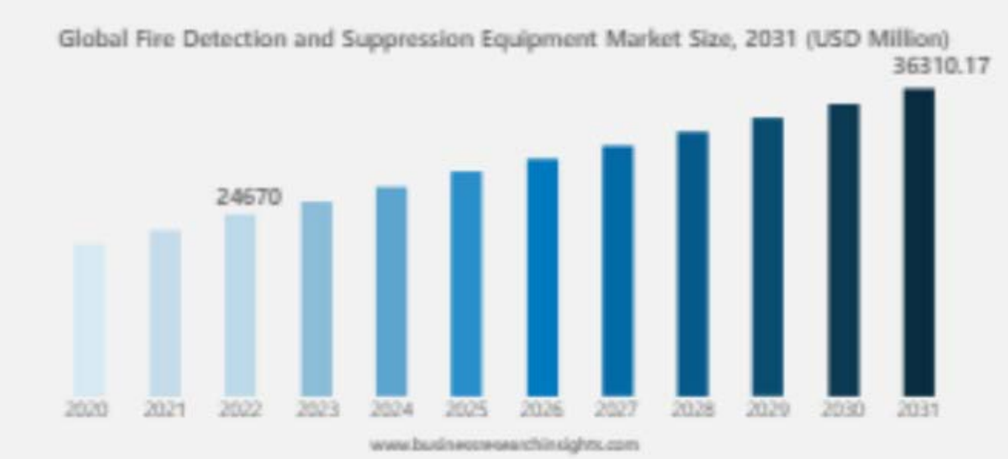
"Kitchen appliances, industrial equipment, and seasonal appliances are the cause of 49.5% of fires"

Market Status

RXO Co., Ltd.

It was valued at USD 246.7 million in 2022 and will reach USD 363.1017 million by 2031, growing at a CAGR of 4.4% during the forecast period.

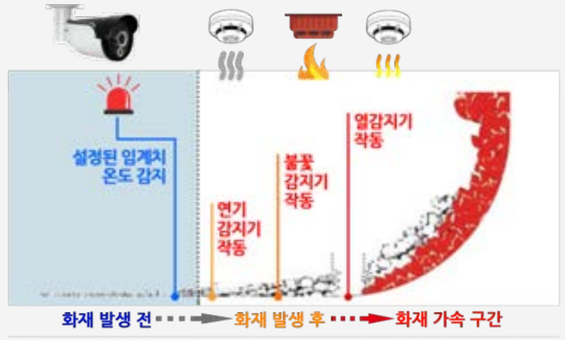
[Market size of fire detection and suppression equipment over 10 years]



The global fire detection and suppression equipment market size was USD 246.7 million in 2022 and is expected to reach USD 363.1017 million by 2031, growing at a CAGR of 4.4% during the forecast period.

There are good reasons for the boom in this market. With the increase in fire incidents across the globe, it is essential to have reliable equipment that can identify and suppress fires. The market today offers a variety of fire detection and suppression products that are designed to address specific types of fire hazards. Smoke detectors are one of the most widely used fire detection devices. These devices are designed to detect smoke particles in the air and sound an alarm when detected. They are often installed in homes and buildings to alert residents of a fire in advance so that they can evacuate safely.

[(주) 큐0스]



- **Function** : Detect fire by attaching thermal imaging camera and other additional heat and smoke detection sensors

- **Limitations :**
1. There are limitations in detecting fires such as electronic devices and cigarette butts with thermal imaging camera
2. Attaching additional sensors is absolutely necessary

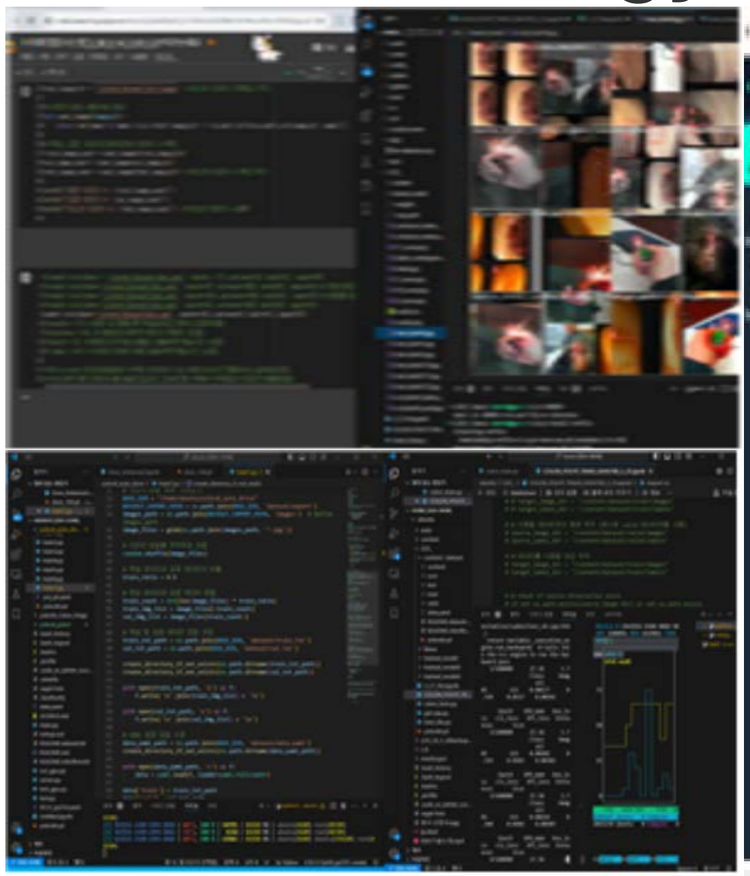
[(주) 온오0시스템]

- **Function** : Detects heat and smoke, and detects a fire when the heat and smoke increase

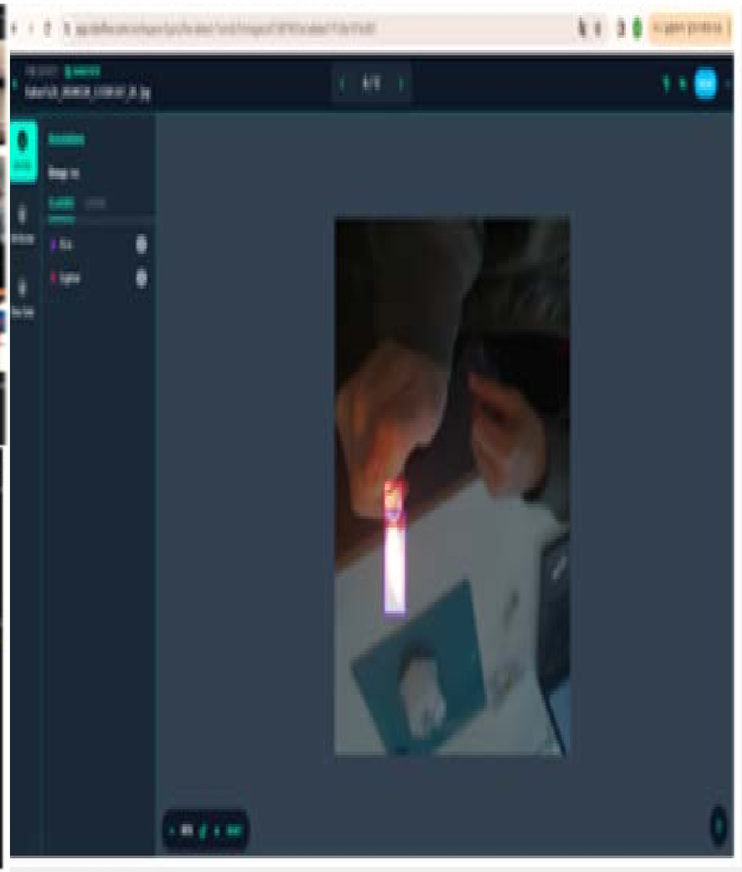
- **Limitations** :
1. Detects a fire when the fire has already progressed to some extent, and it is difficult to detect an early fire
2. It may notify that a fire has occurred due to other factors such as cigarette smoke.

PRODUCT INTRODUCTION

Core technology



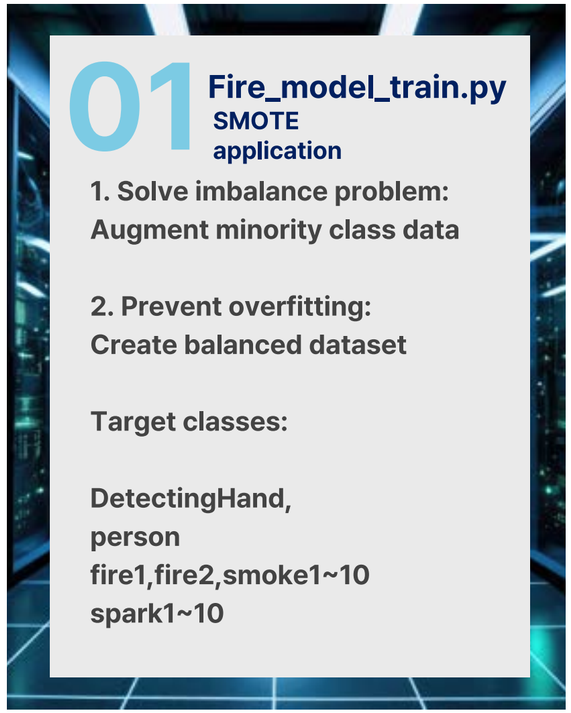
SMALL SIZE FLAME CUSTOM LABELING



Developing a Flame Detection AI Model: Flame Watch Slim

- Data Collection and Labeling: The RoboFlow team directly captured flame data of various sizes and shapes at the fire scene and precisely labeled them to build a dataset for high accuracy.
- Yolov8-based Model: Using the latest object detection algorithm Yolov8, we developed an AI model (befhqhst.pt) that can detect even small sparks and flames. The model was validated using local GPUs in initial testing.

DATA PREPROCESSING



01 Fire_model_train.py

SMOTE application

1. Solve imbalance problem:
Augment minority class data

2. Prevent overfitting:
Create balanced dataset

Target classes:

DetectingHand,
person
fire1,fire2,smoke1~10
spark1~10

02 Fire_app.py

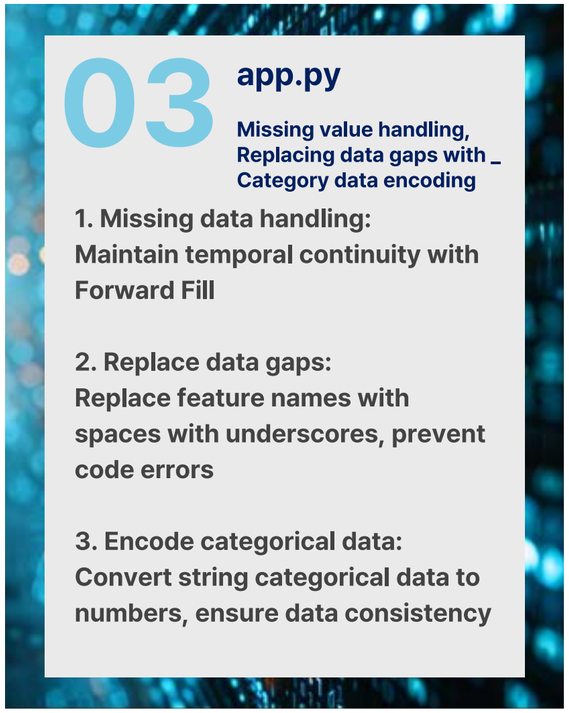
Image Normalization

1. Improved learning stability:
Stable and fast learning

2. Improved performance: Better model performance

3. Improved speed: Faster learning speed

4. Adjusted range:
Keeping the input data range constant



03 app.py

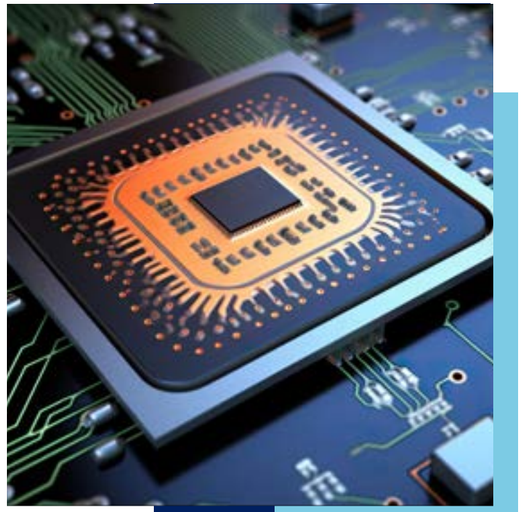
Missing value handling, Replacing data gaps with _ Category data encoding

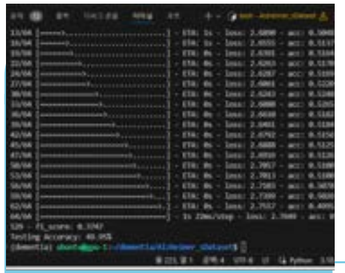
1. Missing data handling:
Maintain temporal continuity with Forward Fill

2. Replace data gaps:
Replace feature names with spaces with underscores, prevent code errors

3. Encode categorical data:
Convert string categorical data to numbers, ensure data consistency

AI-MODEL EVALUATION INDEX





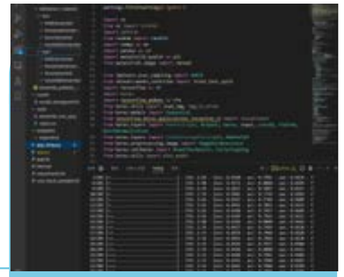
01 Use local GPU

F1_scroe =

0.3747
Testing Accuracy = 49.95%

After training for less than 100 epochs using a local GPU, the evaluation index showed a performance of 37 points out of 1 and a hit rate of 49%.
Since we believe that the model accuracy of Fire Watch Slim is related to life, we planned to improve the accuracy with a target model accuracy of over 90%.

37%

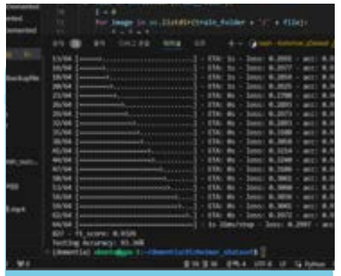


02 Use local GPU

F1_scroe =
0.7898

We used local GPU to improve learning stability and prevent overfitting by using blocks including dense layers, dropouts, and batch normalization.
78 points out of 1
The model performance has improved, but we plan to improve the accuracy because we aim for 90 points or more and 90% or more accuracy.

78%



03 Using H100 GPU

F1_scroe =

0.9326
Testing Accuracy =

93.36%
Using NHN's H100 GPU to modify parameters,
EarlyStopping: To prevent overfitting, training is stopped if there is no performance improvement for a certain number of epochs.
ModelCheckpoint: To preserve the optimal model by saving the best performing model.
Compile the model using Adam optimizer and Categorical Crossentropy loss function. This succeeded in increasing learning speed and accuracy.

93%

Possession of high-accuracy AI models using supercomputers

NO	사업명	선정내용	지원기관	지원기간
1	AICA Data Services	(AICA) T4100*8 Accelerator and 100TP Storage HPC Selection	AICA	2022
2	NIPA Selected for Large-Scale AI High-Performance Computing Support Project	NIPA Selected for Large-Scale AI High-Performance Computing Support Project 20TF	NIPA	2022.10
3	NIPA Selected as the Largest Supercomputer	NIPA Selected as the Largest Supercomputer	NIPA	2023.01
4	AICA Service Plus Selection	AICA Service Plus Selection	AICA	2023.06
5	2023 AI Data Center Service User Continuous Recruitment (Second Half)	Selected resources: Dedicated pool (A100*8) Storage: 500TB	AICA	2023.11
6	2023 AI Data Center Service User Continuous Recruitment (Second Half)	Selected Resource: Dedicated Pool (H100) Storage: 500TB	AICA	2023.11
7	2024 Artificial Intelligence Industry Convergence Business Unit 3rd Supercomputer Public Pool A100 Selected	Selected Resource: Dedicated Pool (H100) Storage: 500TB	AICA	2024.07

High accuracy

Developing higher accuracy models using supercomputers and self-improvement through continuous learning

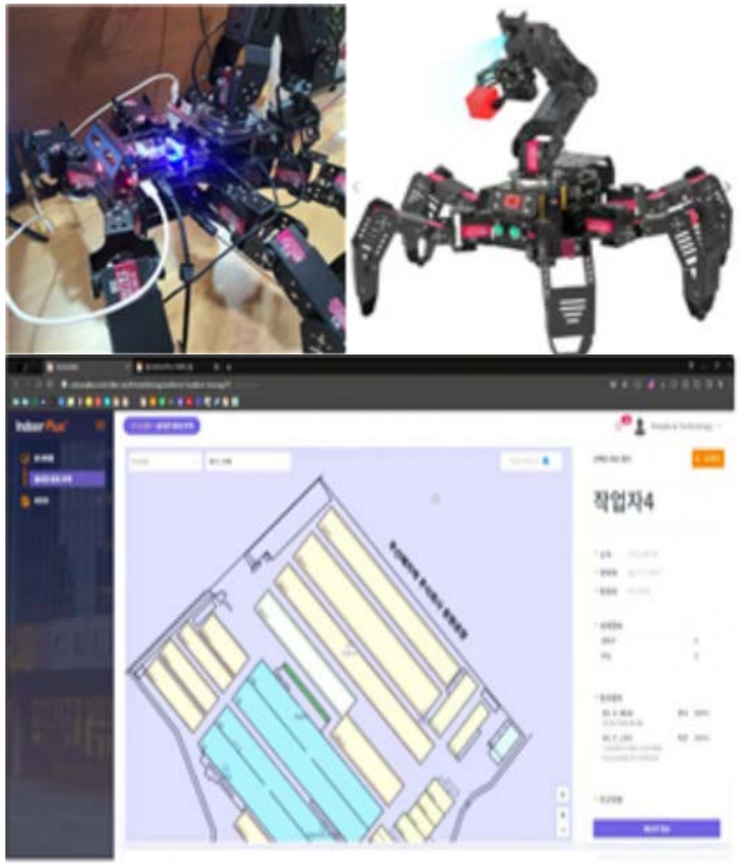
Independent model development

Fast and accurate control and cost reduction through self-model development

Own cloud server

Reduce costs by operating and managing your own cloud server

Firebot Scout



ROBOT EQUIPPED WITH FIRE WATCH SLIM

1. Item Name: FireBot Scout

2. Item Purpose:
FireBot Scout is a robot-based system developed to quickly and accurately detect flames and toxic gases in the early stages of a fire, ensuring the safety of firefighters and maximizing the efficiency of fire suppression.

3. Technology Composition:
- Robot Platform: Utilizing HiWonder robot technology to create a robust and easy-to-operate robot
- Detection System: High-precision flame and toxic gas detection through Yolov8-based AI camera
- Communication System: Establishing a stable communication link for real-time data transmission
- Durability and Safety: Rugged design that can operate stably even in high-temperature and toxic environments

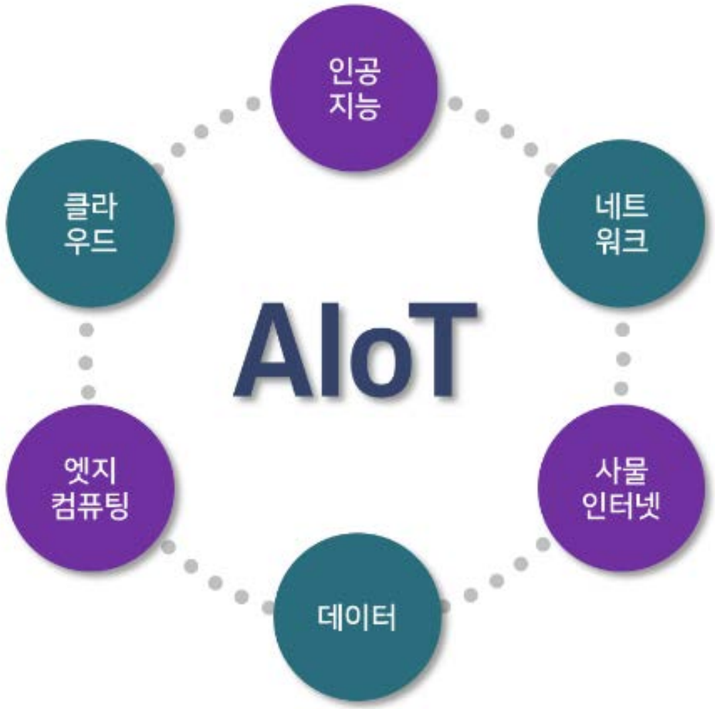
AI - CUSTOM MODEL USING YOLOV8 LIBRARY

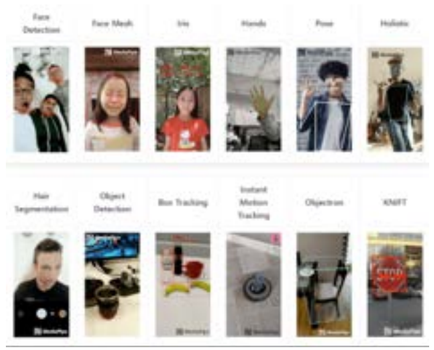
- Face Detection (web demo)
- Face Mesh
- Hand Detection
- Hand Tracking (web demo)
- Multi-hand Tracking
- Hair Segmentation (web demo)
- Object Detection
- Object Detection and Tracking
- Objectron: 3D Object Detection and Tracking
- AutoFlip: Intelligent Video Reframing
- KNIFT: Template Matching with Neural Image Features

RXO

FIREBOT SCOUT

The Yolov8 AI camera, which plays a key role in this system, has high precision to detect even the smallest flames. This allows for rapid detection and response to fires in their early stages, ultimately ensuring the safety of rescuers and reducing property damage.





RXO's AI + IoT Convergence Technology

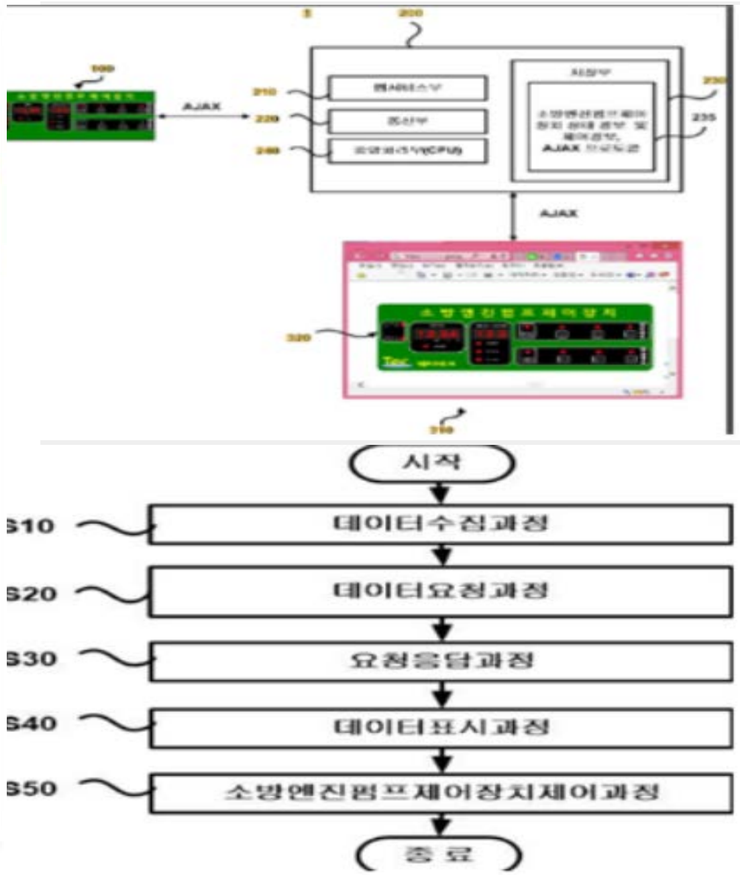
Innovative Integrated Solution:

We at RXO have developed a customized AI training model using MediaPipe. This advanced model can be integrated with over 30 different IoT devices and boards to implement a wide range of smart applications.

RXO Cloud System

HAZARD ALARM SYSTEM

MONITORING CONTROL EFFICIENCY, AI-BASED ANALYSIS



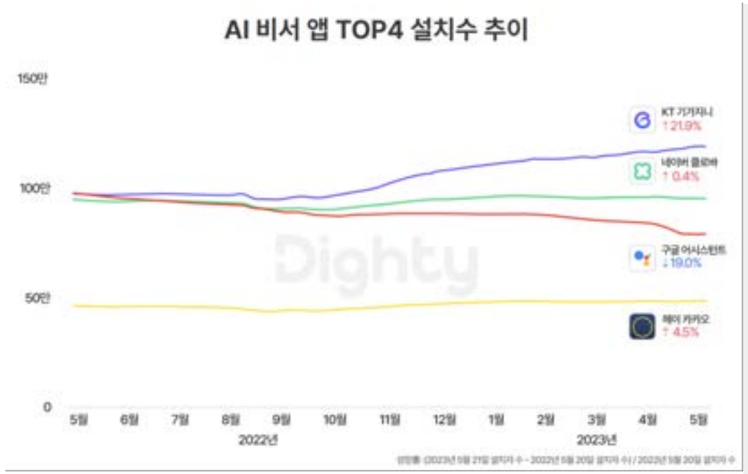
Unified Monitoring System

RXO's IoT-based platform collects real-time data from all devices and manages it centrally. The system allows users to efficiently monitor and control devices anytime, anywhere through remote control and automated alerting systems.

Advanced AI Analytics

Utilizing AI technology, it analyzes collected data, learns patterns, and builds predictive models. This enables improved decision support and continuous optimization of system performance.

Discriminatory advantage



Technological Advantage

- High-precision sensors and data analytics:
- Use of higher-precision sensors than competitors
- Fast and accurate control through real-time data analytics
- AI and machine learning
- Continuous learning and performance improvement using AI technology
- Providing customized services through predictive models

Cost efficiency

- Reasonable price:
- Expanding market share through competitive pricing
- Reducing initial purchase and maintenance costs

Energy efficiency

- Long-term cost savings through efficient energy use
- Additional cost savings through the introduction of eco-friendly technologies

DOMESTIC AND OVERSEAS PERFORMANCE

RXO Co., Ltd.

PRESS

Global business expansion and AI innovation

Salamanca/Magdalena Contreras Ai R&D Project

$1 million MOU signed and project underway

Vietnam Innovation hub Danang signs $2 million MOU for Hekate Technology JSC Smart City Ai R&D project

Demetio NDA contract signed

AI Smart City Project in Vietnam Danang project underway

Strengthening global cooperation

Sichuan Kunpeing Cloudmap Co., Ltd. Ltd 5 years

100,000 USD MOU signed

Korea-Philippines Smart City Roadshow RXO & SRDP [Philippines] 10 years

10,000,000 US Dollar MOU signed

KOTRA] Selection of the 1st generation of digital trade manpower and enterprise (deXters) training project in 2024.

Selected for 2024 Chosun University K-BioHealth Regional Center support project

Selected for the first round of AICA global network construction support project

Overseas branch office work in progress

Construction of RXO Co.,Ltd. Thailand branch office

Signing of MOU contracts worth $50 million with foreign companies over the next 10 years

다낭 IT Park | 베트남 Hekate | 베트남 SIBAI MOU | 베트남 Innovation Hub | 아프리카 CCM

중국 Sichuan Kunpeing Cloudmap | 폴란드 InvestPark MOU | 필리핀 Aeroeye Asia MOU | 필리핀 SRDP | 폴란드 KSSE MOU

Experience in carrying out various overseas AI R&D projects and international experience

AI Magdalena Contreras Project Performed

Danang project ends

Mexico Magdalena Project presentation

Royal Thai Government Smart City Meeting

Chiang Rai City in Thailand Meeting

RXO AI Smart Cirt Project

Main products "8"

Signing of MOU contracts worth $50 million with foreign companies over the next 10 years

DANANG IT PARK
Information Technology Park

LEASE LAND PRICE LIST

Danang IT Park

소프트웨어 계약서(software contract)

Vietnam Hekate

RXO Co.,Ltd. and SIBAI VIET NAM Co.,Ltd. M

Vietnam SIBAI MOU

RXO Co., Ltd. and VIETTEL GROUP MOU.

Vietnam Innovation Hub

M O U (Memorandum of Understanding)

African CCM

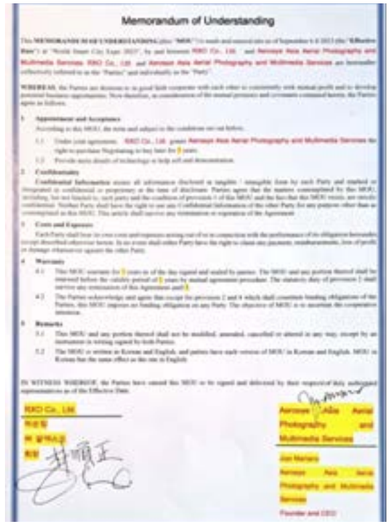
Memorandum Of Understanding

China Sichuan Kunpeing Cloudmap

RXO Co., Ltd. and Invest Park MOU.

From Poland

Poland InvestPark MOU


Memorandum of Understanding

Philippines Aeroeye Asia MOU

Memorandum of Understanding

Philippine SRDP

RXO Co., Ltd. and KSSE MOU.

From Poland

Poland KSSE MOU

Vietnam Hekate Software Contract

$50 Million

소프트웨어 계약서(software contract)

This **ware contract** (this "**contract**") is made and entered by and between **RXO Co., Ltd.** and **Hekate** . **RXO C Ltd.** and **Hekate** are hereinafter collectively referred to as the "Parties" and individually as the "Party".

WHEREAS, the Parties are desirous to in good faith cooperate with each other to consistently seek mutual profit and to develop potential business opportunities. Now therefore, in consideration of the mutual premises and covenants contained herein, the Parties agree as follows;

1 **Appointment and Acceptance**

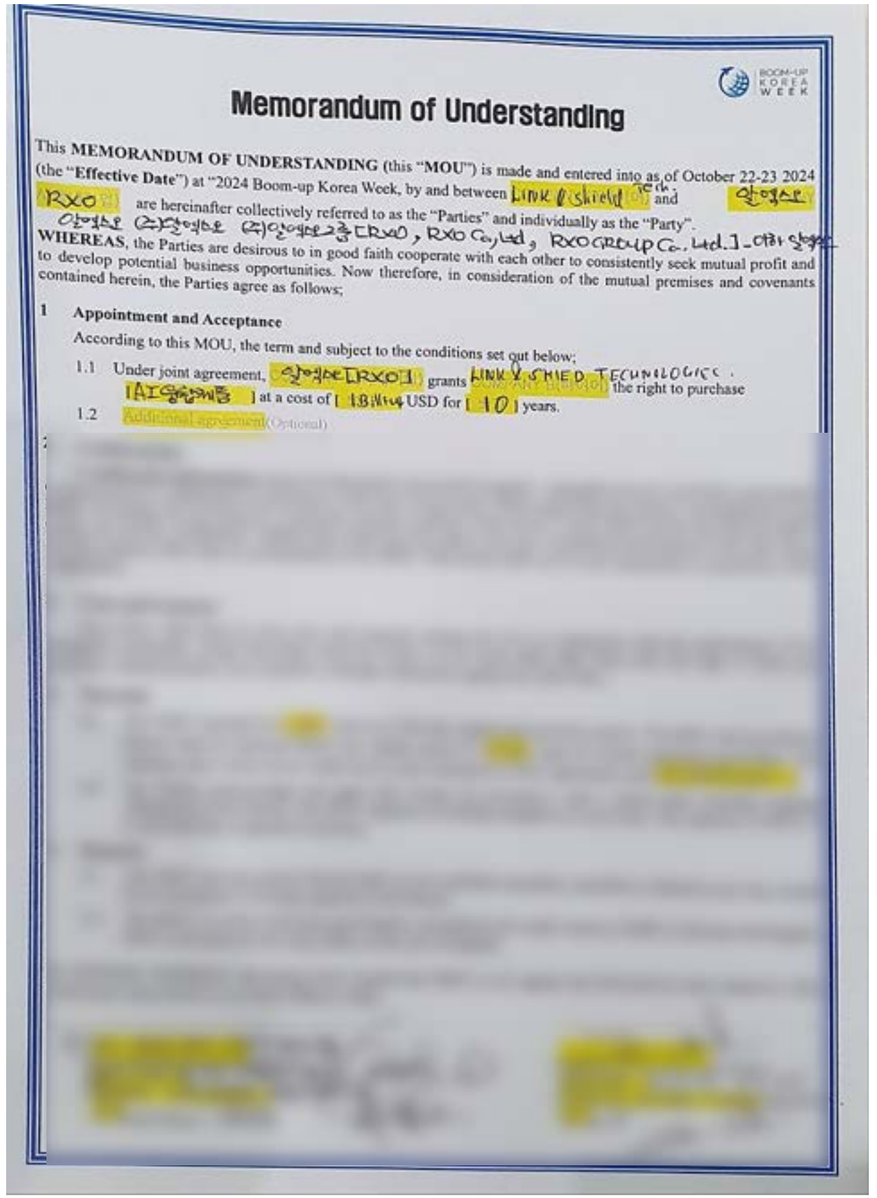
According to this contract , the term and subject to the conditions set out below;

1 Under joint agreement, **RXO Co., Ltd.**grants **Hekate** the right to purchase **[AI Technology]** at a cost of **[50,000,000]** USD for **[10]** years.

2 Cooperation on developing AI technology for Smart Cities and Smart Manufacturing Factories in Vietnam and Korea

Qatar Dubai Signs MOU

$1 Billion



BOOM-UP KOREA WEEK

Memorandum of Understanding

This **MEMORANDUM OF UNDERSTANDING** (this "**MOU**") is made and entered into as of October 22-23 2024 (the "**Effective Date**") at "2024 Boom-up Korea Week, by and between LINK V SHIELD TECH. and RXO are hereinafter collectively referred to as the "Parties" and individually as the "Party".

WHEREAS, the Parties are desirous to in good faith cooperate with each other to consistently seek mutual profit and to develop potential business opportunities. Now therefore, in consideration of the mutual premises and covenants contained herein, the Parties agree as follows;

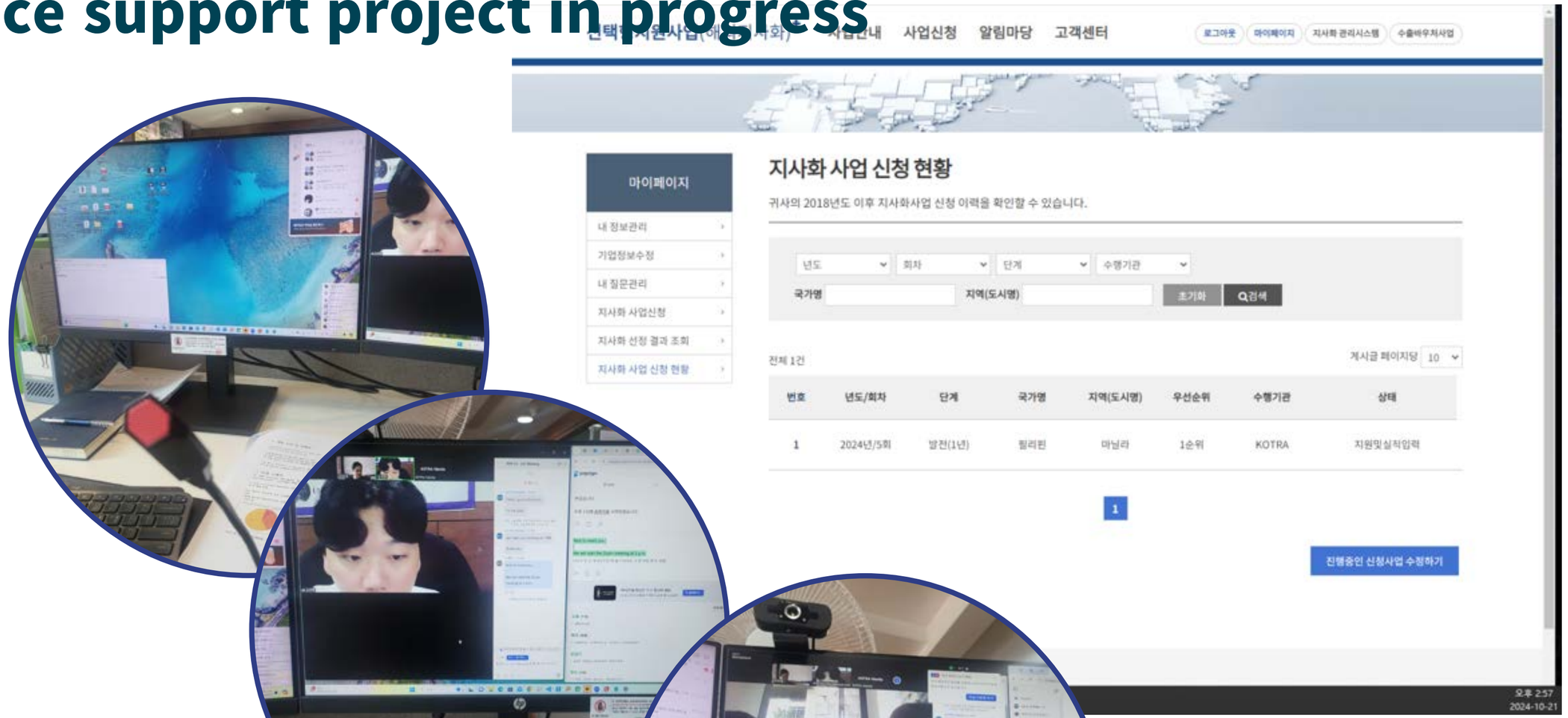
1 Appointment and Acceptance

According to this MOU, the term and subject to the conditions set out below;

1.1 Under joint agreement, [redacted] grants [redacted] the right to purchase [redacted] at a cost of [redacted] USD for [10] years.

1.2 Additional agreement (Optional)

KOTRA-linked Manila, Philippines branch office support project in progress



Overseas branch office work in progress

Construction of RXO Co.,Ltd.
Thailand branch office

Korea-Thailand Economic Cooperation Forum

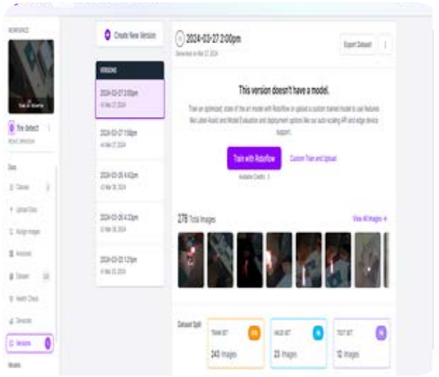
Thailand's Big 3 Banks Visit Consulate

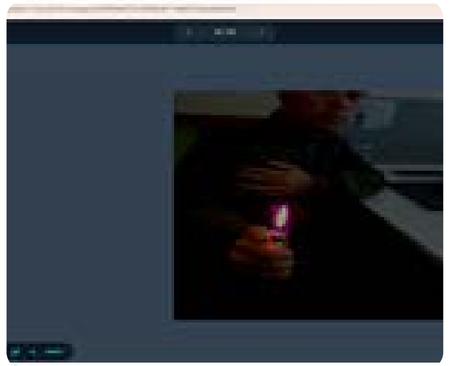
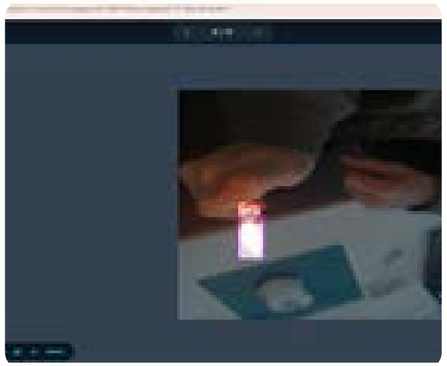
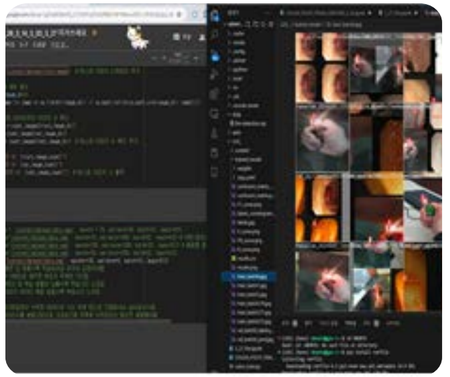
Thailand Ban Chang Government Meeting

PROVIDE SOLUTIONS

Big data

Using Custom Data



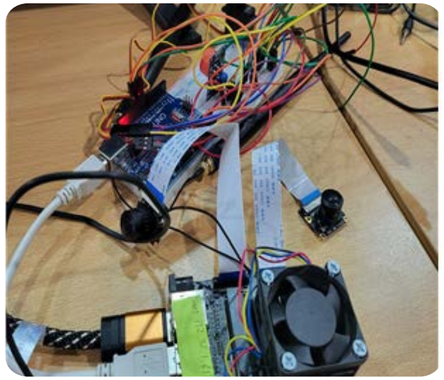
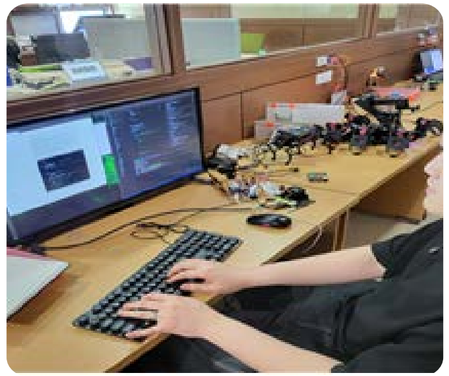
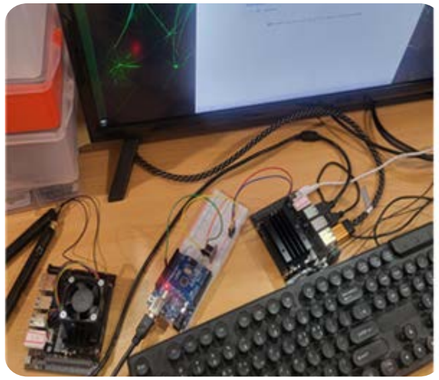




Ensure you don't miss out on microscopic initial sparks that can occur in a small space

In our project, we have revolutionized the precision and responsiveness of flame detection technologies through advanced data processing and custom data generation. Using self-photographed and labeled flame images, we solved data problems that are generally difficult to access. Through this process, we developed a customized model that can detect even small-sized flames.

Utilize IOT

Using camera, IOT sensor

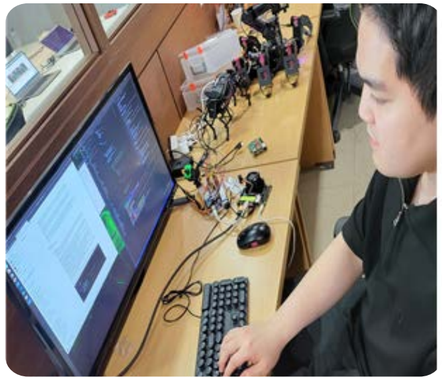
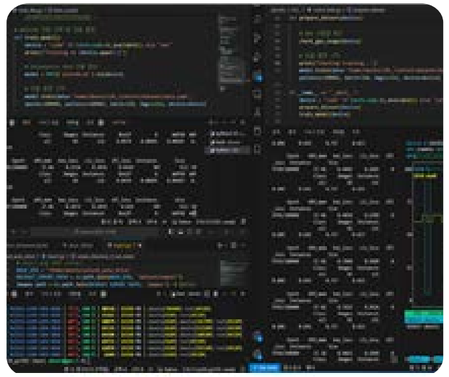




Monitor real-time sensor values for fire prevention using IOT

By fusing the Jatson nano, IOT sensor, and board, we were able to implement a fire prevention and fire diffusion prevention system.
It can be equipped with functions such as fire extinguisher injection to prevent the spread of fire by early diagnosis of fire with various sensors,
You can build a customized fire prevention and suppression system.

Model Learning

Improve H100 utilization accurac

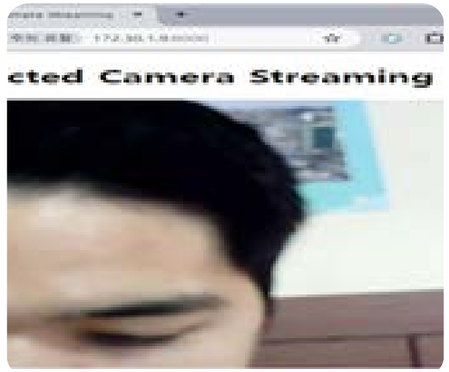



Utilize Kirstem data and H100 GPU

To maintain the maximum performance of flame object detection capabilities of small-sized fireworks and fast AI models that are important for fire suppression
Using the H100 gpu assigned by the company, we created and used our own fire flame detection AI model.

remote control

Independent server operations



Minimize maintenance costs with independent servers

Enables monitoring of sensor values with dynamic graphs, and users who manage databases and engine rooms are real-time on the computer

You can simultaneously detect sensor values, flame objects, and check internal conditions through cameras.

Since it is a server of Jatson nano itself, there is little maintenance cost.

RXO Co., Ltd.

Mexico Contreras June 23

MOU Agreement

César Prieto Gallardo y Ih Rang Kim, representante de la Oficina Comercial de la Embajada de Corea del Sur. Foto: Cuca Domínguez

Soon Jeong Park, representante de la empresa coreana RXO, dijo que luego de interesarse en invertir en México, visitó a Salamanca. Le impresionó y tomó la decisión de quedarse en

Salamanca, Mexico March 23

Experience in carrying out various overseas AI R&D projects and international experience

AI Magdalena Contreras Project Performed

Danang project ends

Mexico Magdalena Project presentation

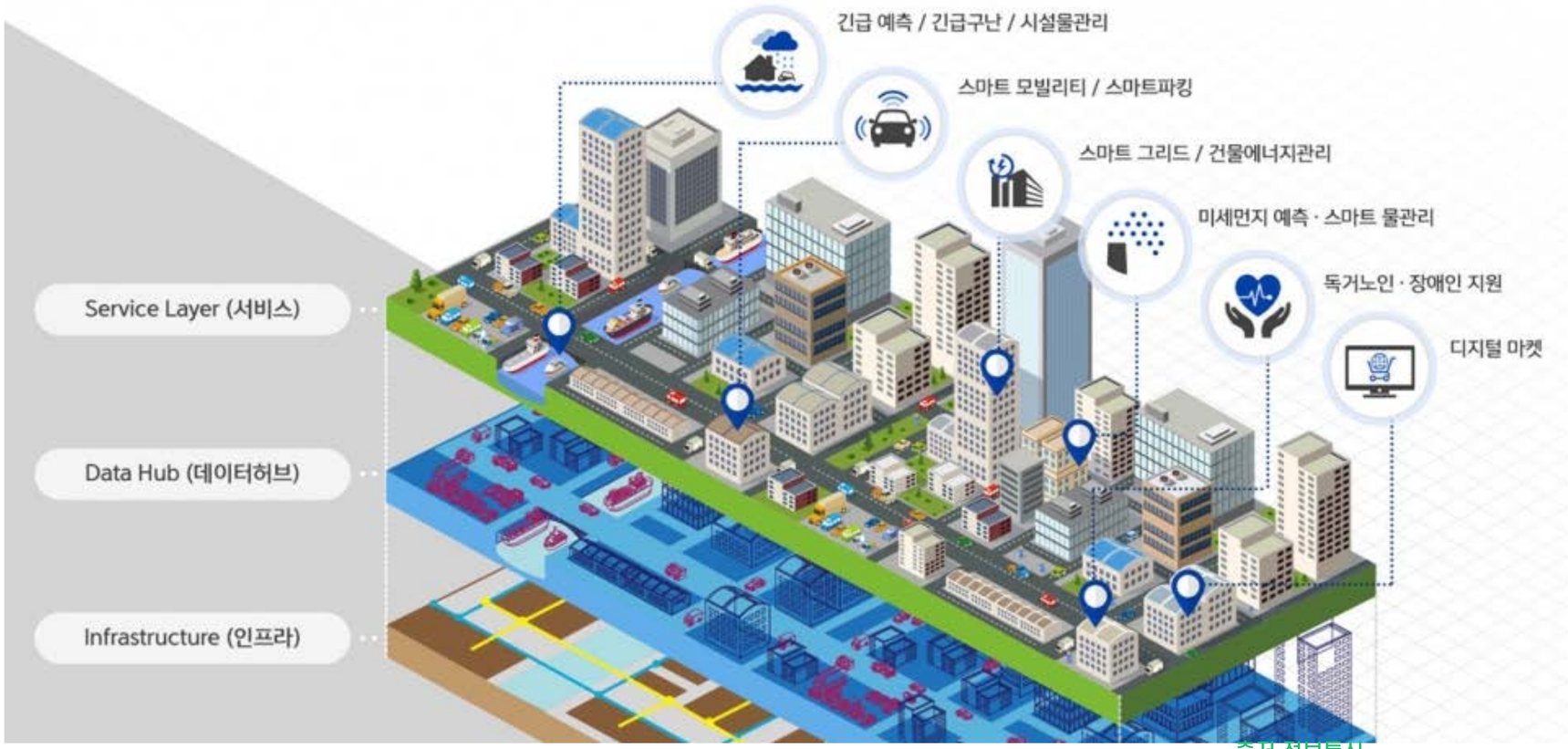
Royal Thai Government Smart City Meeting

korea-serbia Project & Inveent B2B Meeting

Chiang Rai City in Thailand Meeting

RXO AI Smart City Project

Hanoi Demetio Meeting



출처 정보통신

RXO

SMART CITY

Use artificial intelligence technology to collect, analyze, and predict data generated in cities to provide customized platform services for consumers

RXO, a Multinational Company
Leading Global Strategy

Smart City Market Positioning

Parking lot fire detection system
DETECTS FIRE IN THE PARKING LOT AND PROVIDES A REMOTE MONITORING SYSTEM

Smart Parking Management System
SOLUTION TO SOLVE THE PROBLEM OF ILLEGAL PARKING BY SAVING THE DRIVER'S MOVEMENT

Smart Electronics Control Solutions
PROVIDES AN ELECTRONIC DEVICE CONTROL SYSTEM REMOTELY WITHOUT BUTTON OPERATION

Smart Doorbell System
STRENGTHEN SECURITY AND ENHANCE USER CONVENIENCE BY UTILIZING FACE RECOGNITION AND EYE RECOGNITION

Data Center Fireworks Detection System
FINE FIREWORKS, SPARKS, CAMERA SENSORS USE TO DETECT AND RESPOND EARLY

Smart City Control Center
BY REMOTELY MONITORING AND CONTROLLING SMART CITY IMPLEMENTATION

RXO, a Multinational Company
Leading Global Strategy

an unrivaled position in the industry

Customer service through continuous source technology development and market-leading solutions

High-Performance AI Model

It builds its own high-level AI models using its assigned supercomputers H100, A100, and NPU.

Reduce server costs

It utilizes Odroid, Jatson Nano, Raspberry, and Arduino boards to operate the platform without being allocated a cloud server and without spending on server costs.

Customized

We provide customized solutions in various fields such as smart homes, smart desks, smart farms, and smart pectories.

RXO Co., Ltd.

Fire Watch Slim proposal

Thank you