

# Building Crack Detection Drone Safety Management System

Utilizing YOLO, SSD, and Faster R-CNN



# The Importance of Building Safety Management

The importance of systematic safety management is being highlighted due to the aging of buildings and the increase in safety accidents.

## The need for safety management and the limitations of existing methods

Traditional visual inspection methods are time-consuming and costly, and have limitations in inspecting difficult-to-access areas. In addition, the possibility of human error is high, making it difficult to ensure accuracy and consistency.



# Drone Utilization Safety Management System

## Development of drone technology and its role in safety management systems

Advances in drone technology are bringing about revolutionary changes in building safety management. Drones equipped with high-resolution cameras and AI technology can quickly and safely inspect even difficult-to-access areas. Real-time data collection and analysis are possible, enabling immediate responses, and regular monitoring can track the progress of cracks. This enables preventive maintenance, greatly contributing to the prevention of safety accidents and cost reduction.

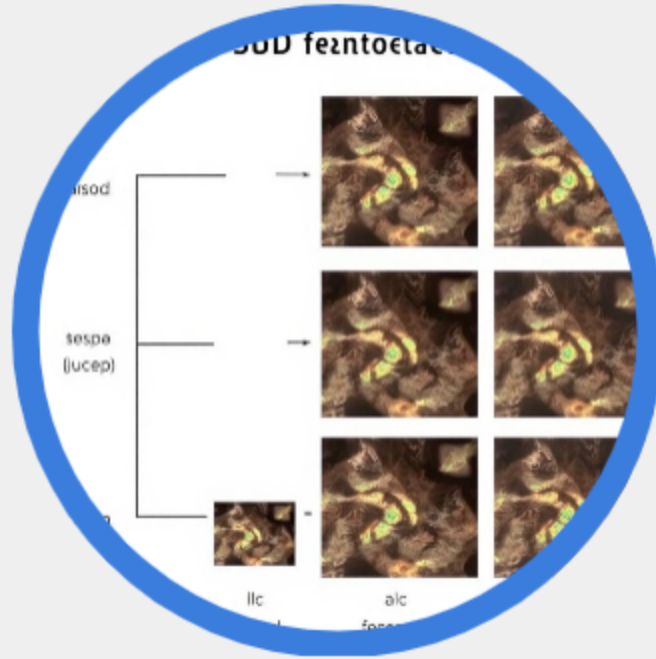


# Object Detection Algorithm Overview



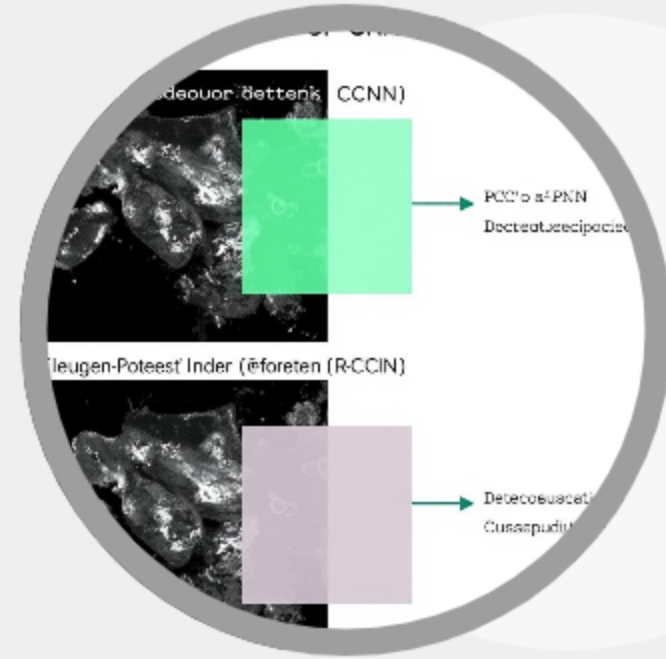
**YOLO (You Only Look Once)**

An algorithm that can detect objects in real time using a single neural network. It has the advantage of being fast, but has a weakness in detecting small objects.



**SSD (Single Shot Detector)**

An algorithm that effectively detects objects of various sizes. It has a good balance of speed and accuracy and is suitable for real-time processing.

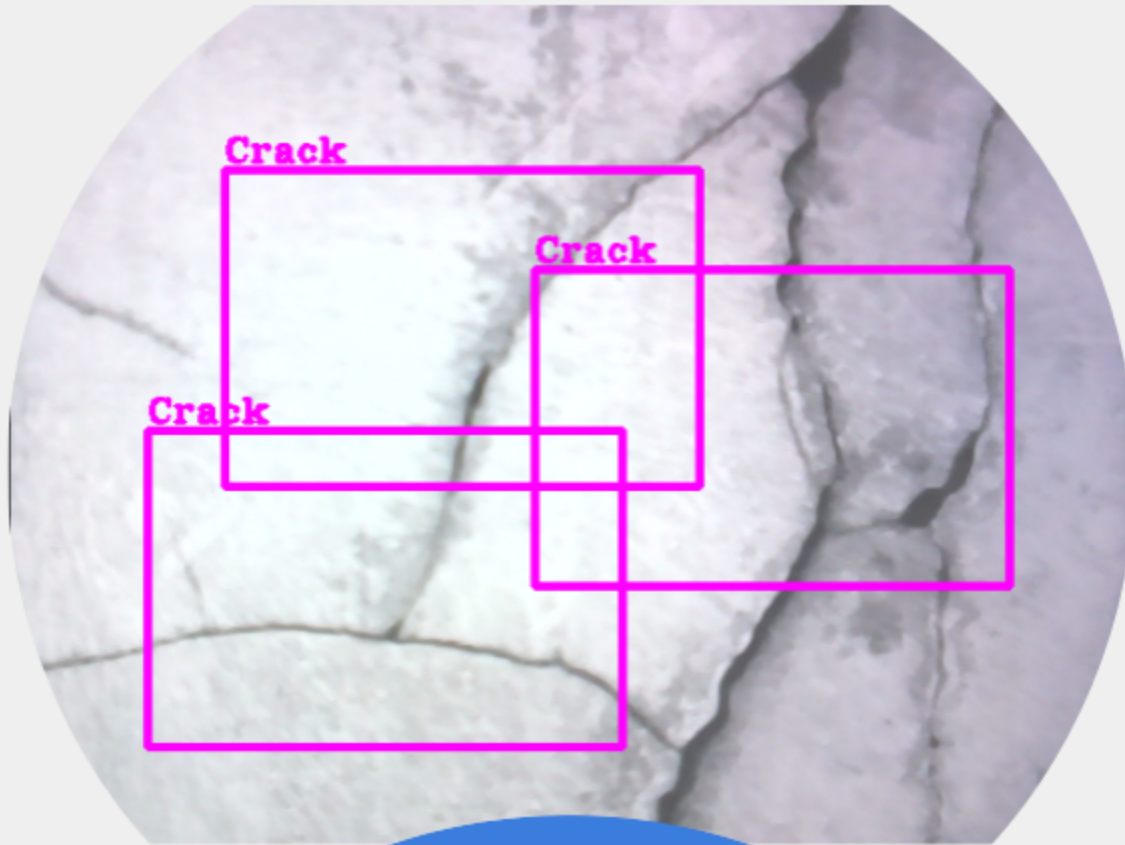


**Faster R-CNN**

A two-stage detection algorithm boasting high accuracy. It is capable of detecting detailed objects in complex scenes, but the processing speed is relatively slow.



Result



# Crack detection using YOLO

## Features of the YOLO algorithm

YOLO works very fast by handling object detection with a single neural network. It looks at the image only once and predicts the location and class of the object simultaneously.

## 건물 균열 감지에 YOLO 적용

Applying YOLO to building crack detection can detect cracks in drone camera footage in real time. It can efficiently inspect large areas with fast processing speed.

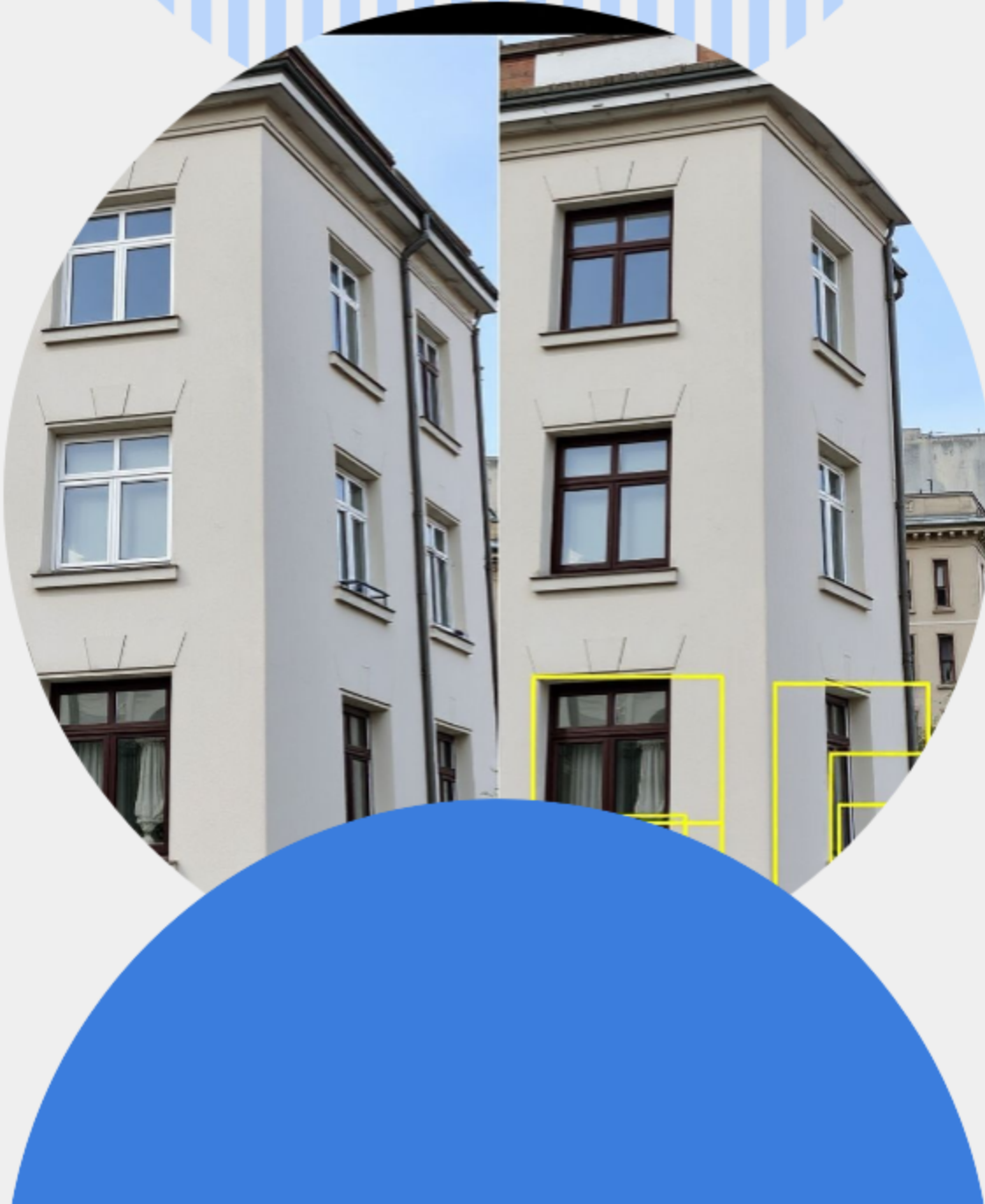
# Crack Detection Using SSD

## Features of SSD algorithm

SSD is a single-step object detection algorithm that effectively detects objects at multiple scales by using feature maps of different sizes.

## Applying SSD to Building Crack Detection

Applying SSD to building crack detection can detect cracks of various sizes simultaneously. It can effectively identify small to large cracks, enabling accurate safety diagnosis.



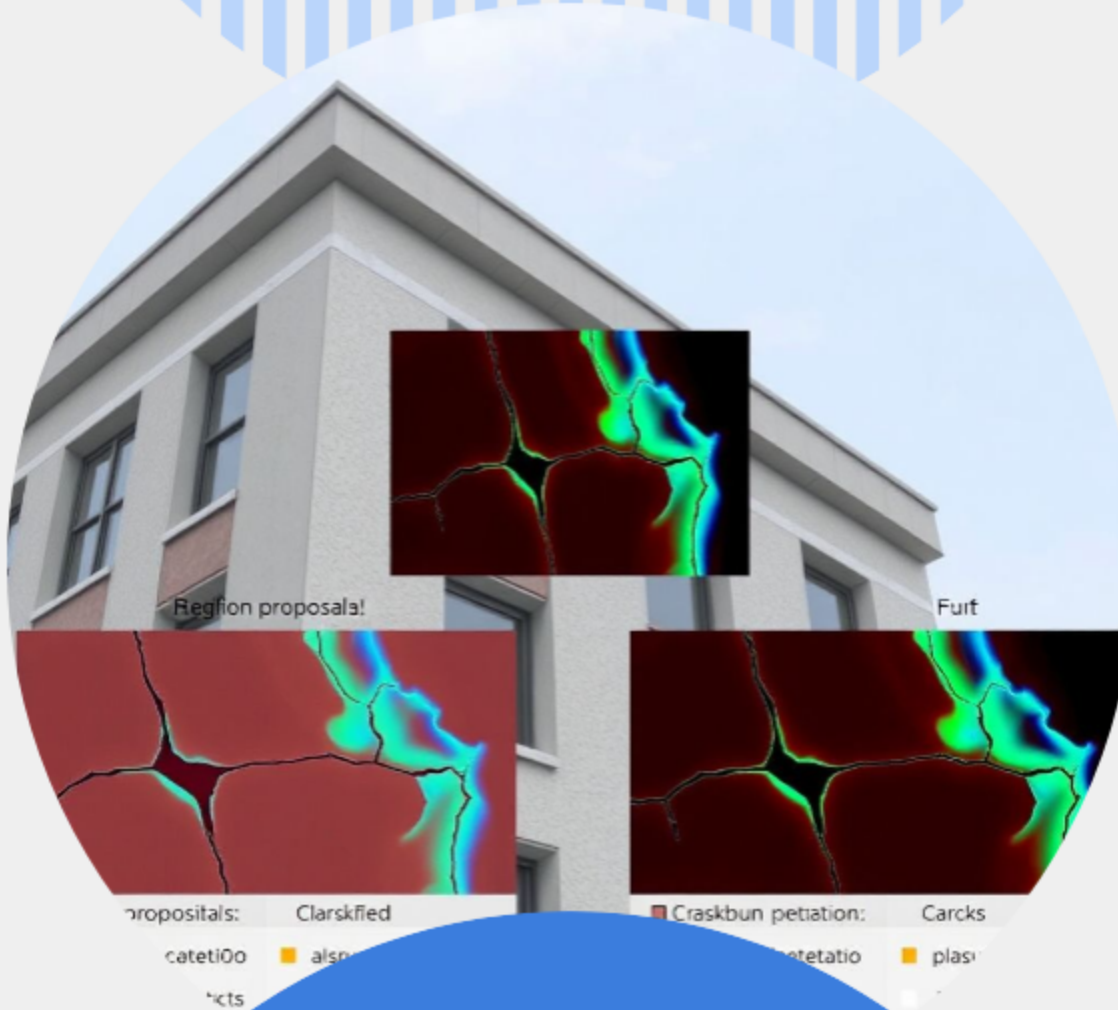
# Crack Detection Using Faster R-CNN

## Features of the Faster R-CNN algorithm

Faster R-CNN is a two-stage object detection algorithm that uses a Region Proposal Network to propose and classify object locations.

## Applying Faster R-CNN to Building Crack Detection

Applying Faster R-CNN to building crack detection can detect cracks with high accuracy. Precise crack location can be identified even in complex building structures.



# Algorithm performance comparison

## Performance characteristics of YOLO and SSD

YOLO and SSD have the advantage of fast processing speed. YOLO is suitable for real-time processing, and SSD is strong in detecting objects of various sizes. However, the accuracy may be somewhat reduced for small objects or complex scenes. The memory usage is relatively small, allowing efficient resource utilization.



## Performance characteristics of Faster R-CNN

Faster R-CNN has the advantage of high accuracy. It performs well in complex scenes or small object detection. However, its processing speed is slower than YOLO or SSD. It also uses relatively more memory, so it may require high-performance hardware. It is suitable for cases where precise crack detection is required.





# System implementation



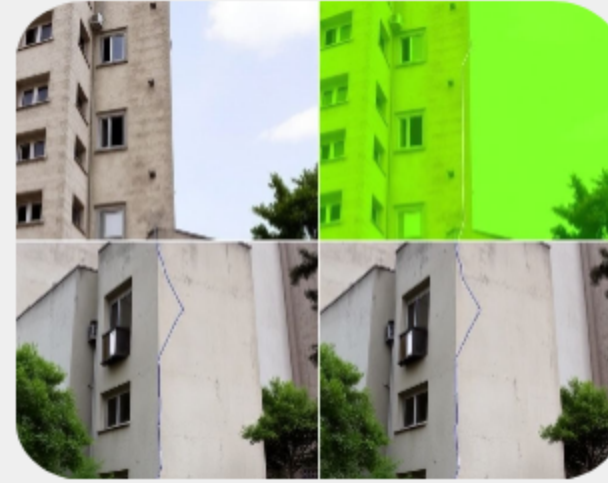
## Drone hardware configuration

Drones equipped with high-resolution cameras, GPS, and stabilizers. Battery optimization for long-term flight. Equipped with communication modules for real-time data transmission.



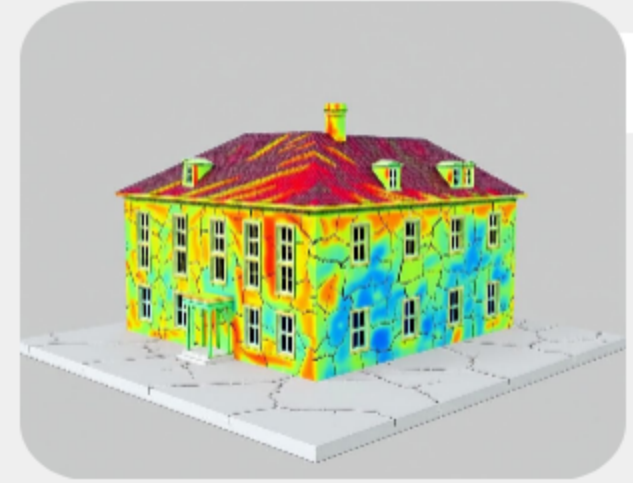
## Data collection process

The drone flies automatically along a pre-planned route. Scans the building exterior at regular intervals and captures high-resolution images. Saves the images along with GPS data.



## Applying crack detection algorithm

Apply YOLO, SSD, and Faster R-CNN algorithms to collected images. Detect cracks of various sizes and shapes by utilizing the advantages of each algorithm.



## Data processing and analysis

Transmit detected crack data to a central server. Analyze crack location, size, and severity. Visualize crack distribution through 3D modeling. Monitor crack progression over time.



# Real-world applications

**Alcaldía La Magdalena Contreras** 2 h ·

¡Súmate a la capacitación para el uso de tecnologías 4.0 impartido por la compañía Coreana RXO World Corp!

**RXO AI SMART CITY PROJECT IN MÉXICO**  
ALCALDÍA LA MAGDALENA CONTRERAS

La Alcaldía La Magdalena Contreras en conjunto con la compañía coreana RXO World Corp, buscan impulsar la generación de talento humano en el uso de Tecnologías 4.0 para el cual tendrán acceso a soluciones como: reconocimiento facial, detección de objetos e identificación de gestos emocionales, uso de sensores, manejo de base de datos, entre otras funciones.

**12 al 30 junio 2023** De 9:00 a 16:00 hrs. **C2 ALCALDÍA LA MAGDALENA CONTRERAS**

Para más información y registro enviar un correo electrónico a [alcaldiainteligente@gmail.com](mailto:alcaldiainteligente@gmail.com) o puede comunicarse a través del teléfono (49) 9105-5178



Mexico City News

**MOU 계약서**

1. 양 당사자는 본 MOU를 통해 AI 프로젝트의 성공을 위한 협력 관계를 수립한다.

2. 본 MOU는 양 당사자 간의 상호 이익을 증진하고, AI 기술의 발전과 활용을 촉진하기 위한 목적으로 체결되었다.

3. 본 MOU의 내용은 양 당사자의 상호 합의에 따라 체결되었으며, 양 당사자는 본 MOU를 통해 상호 협력 관계를 유지할 것을 약속한다.

4. 본 MOU의 내용은 양 당사자의 상호 합의에 따라 체결되었으며, 양 당사자는 본 MOU를 통해 상호 협력 관계를 유지할 것을 약속한다.

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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

**RXO AI SMART CITY PROJECT**  
In Mexico: Salamanca

Presidencia Municipal de Salamanca

A través de la Dirección General de Desarrollo Económico y la compañía Coreana RXO World Corp., busca impulsar la generación de talento humano capacitado para el uso de Tecnologías 4.0 y abrir oportunidades de desarrollo tecnológico en el municipio, en este sentido:

**CONVOCA A**

Estudiantes de Ingeniería de último semestre que estén interesados en obtener una capacitación para el desarrollo de proyectos con Tecnologías 4.0 para reconocimiento facial, detección de objetos y de gestos de la mano, uso de sensores IoT con manejo de base de datos, entre otras funciones como trainees de la empresa RXO.

**BASES**

- La capacitación tendrá una duración de 4 a 5 semanas en las instalaciones de CNERGIA UG (Ciudad Universitaria No. 112, Comunidad San Rafael de Uribeano, 36880 Salamanca, Guanajuato).
- Los trainees interesados deberán estar inscritos en la División de Ingenierías Campus Irapuato-Salamanca, tener disponibilidad de tiempo, serinos de aprender y realizar el proyecto de desarrollo tecnológico con personal extranjero en corto plazo.
- El cupo es limitado. La empresa RXO World Corp. entrevistará y seleccionará a los estudiantes que serán acreedores a las sesiones de capacitación.

Interesados enviar correo electrónico a [contacto@cnenergiasug.org](mailto:contacto@cnenergiasug.org) o comunicarse a través del teléfono 464 547 39 al 445 2378.

February 22, 2023 : AI project contract signed with Salamanca City, Mexico

23.2.22 멕시코 살라만카시와 RXO 세계의 계약 체결

June 1, 2023 : AI project presentation in Salamanca, Mexico

23.6.1 멕시코 살라만카시 인공지능 프로젝트 발표회

## Mexico City



## Mexico Salamanca





# Real-world applications



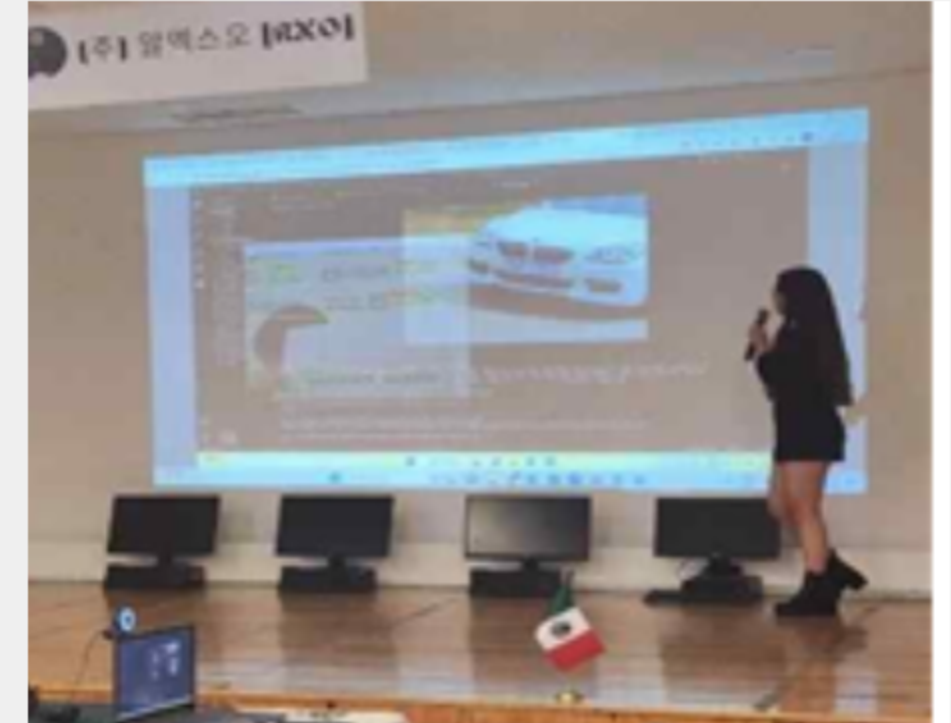
# Real-world applications



**AI Magdalena Contreras  
Project Performed**



**Mexico Magdalena Project  
presentation**



**Royal Thai Government  
Smart City Meeting**