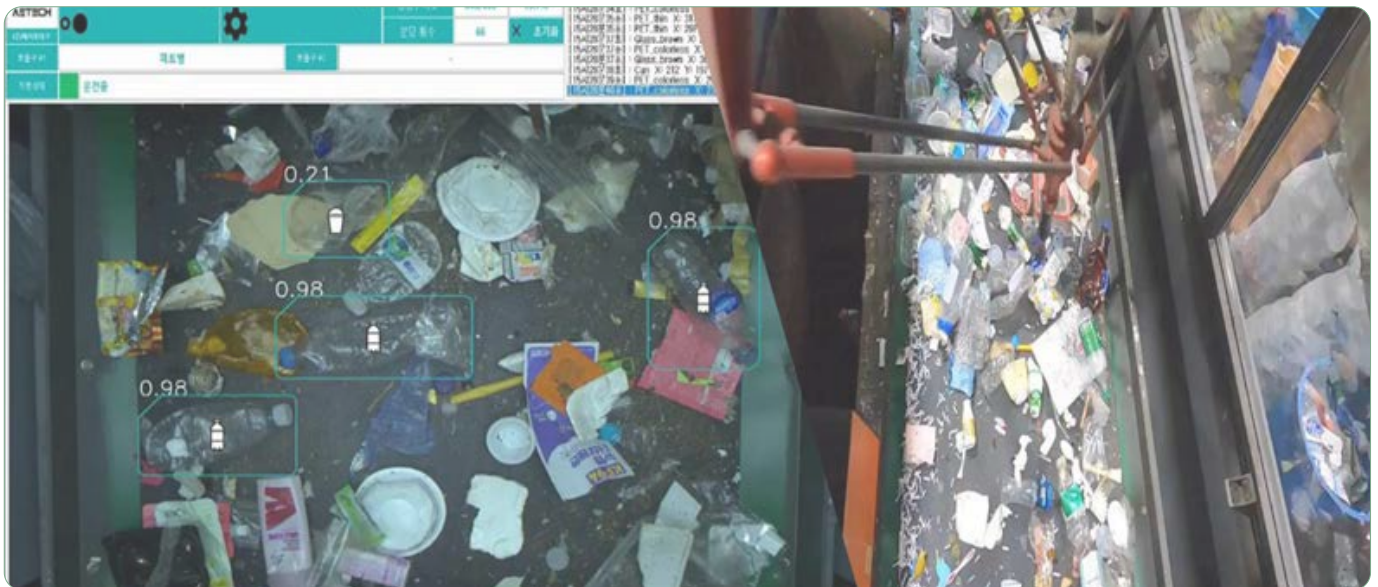# AI-based Waste Sorting Robot

The AI-Based Waste Sorting Robot is a technology equipped with an integrated system that analyzes waste through video processing, identifies recyclable materials, and controls robotic arms to handle transport and sorting.

Compared to traditional labor-intensive methods, it improves waste sorting efficiency, contributing to a sustainable circular economy through reduced environmental pollution.

▲ The AI-Based Waste Sorting Robot identifies different types of waste on the conveyor belt, then suctions and transfers recyclable PET bottles.　　　Source : AETECH

Issues to Tackle

☑ Environmental pollution occurs when recyclable materials in waste are not properly sorted and end up being landfilled or incinerated.

☑ Low productivity due to poor working conditions at waste sorting facilities and manual recycling separation.

Expected Benefits ☑

☑ Reducing environmental pollution of air, soil, and water quality caused by waste landfilling and incineration.

☑ Contributing to a sustainable circular economy by establishing an efficient resource recycling system.

☑ Improving sorting efficiency and reducing industrial accidents by utilizing robots for waste sorting.

☼ Key Services

· Identifying recoverable resources from waste piles using cameras equipped with a vision AI system.

· Detecting individual items and classifying them by type and contamination level from mixed waste images.

· Picking and transferring items using robotics with vacuum suction based on deep learning analysis results.

· Digitalizing work results in operating systems and providing real-time monitoring control of operations.

⚙ Use Cases

· From 2021-2022, Daegu Metropolitan City installed an 'AI Resource Recycling Robot' at the National Water Industry Cluster recycling center for data-based citizen participatory urban problem solving, operating as an open living lab demonstration.

· In 2023, Jeju Province and Jeju City operated an AI Recycling Support Center (AI Waste Sorting Robot) at Jocheon Port, sorting six types of recyclables including clear/colored PET bottles and cans, while transmitting real-time information about load capacity and status to collection vehicles.

Key Components

Configuration

Head

Eyes

Arms

Artificial Intelligence Screen

Vision Camera

Delta Robo
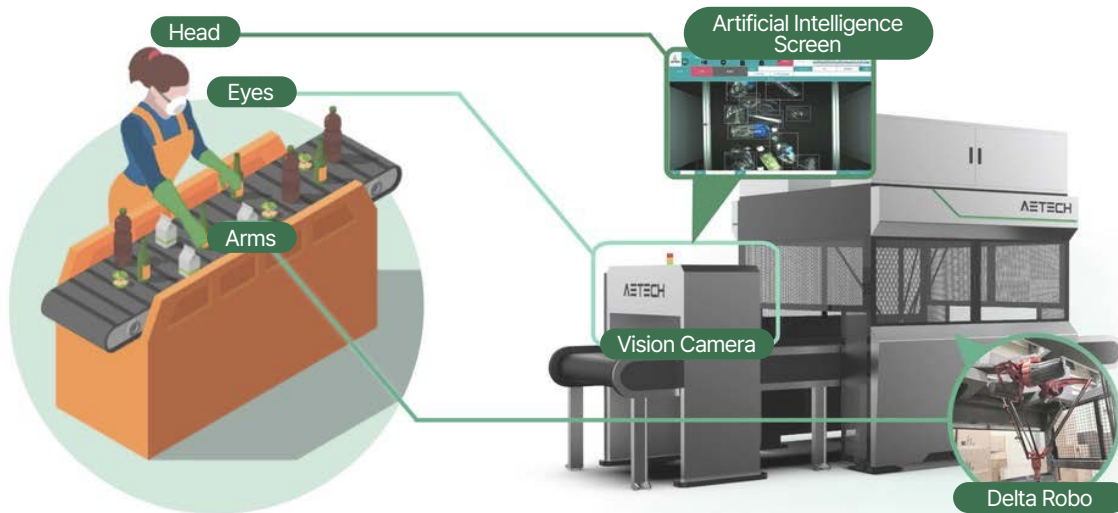
Technology

1. Deep-learning-based waste detection and analysis

· Identifying the types of waste and determining recyclability by analyzing recognized waste materials based on their material, color, and characteristics using deep learning algorithms and vision cameras.
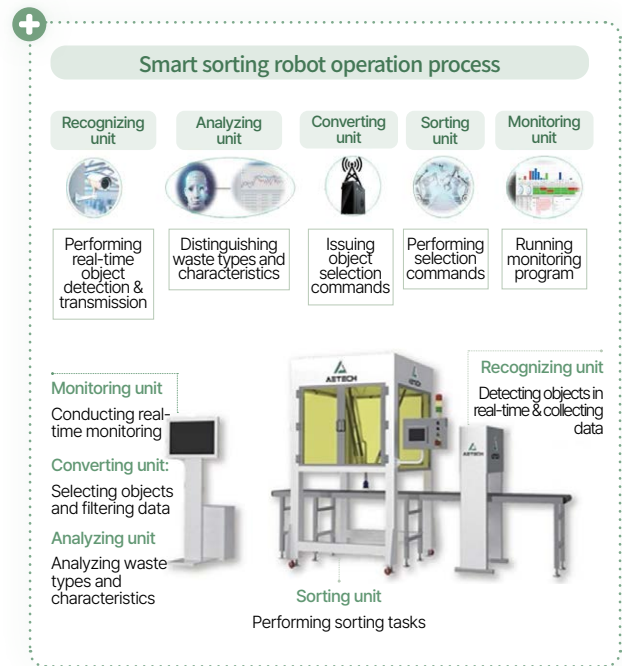
2. Result data retention algorithm

· Maintaining individual object's result data values for a set period while tracking the same object moving along a conveyor belt despite coordinate changes.

3. Object transfer signal algorithm

· Picking operation by synchronizing and signaling the system's timing between conveyor belt speed and the moment when objects are captured in view.

4. Big data

· Building a waste big data system by monitoring waste types and contamination levels in real-time, improving classification accuracy.

Smart sorting robot operation process

Recognizing unit	Analyzing unit	Converting unit	Sorting unit	Monitoring unit
Performing real-time object detection & transmission	Distinguishing waste types and characteristics	Issuing object selection commands	Performing selection commands	Running monitoring program

Monitoring unit
Conducting real-time monitoring

Converting unit:
Selecting objects and filtering data

Analyzing unit
Analyzing waste types and characteristics

Recognizing unit
Detecting objects in real-time & collecting data

Sorting unit
Performing sorting tasks

Source : AETECH

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