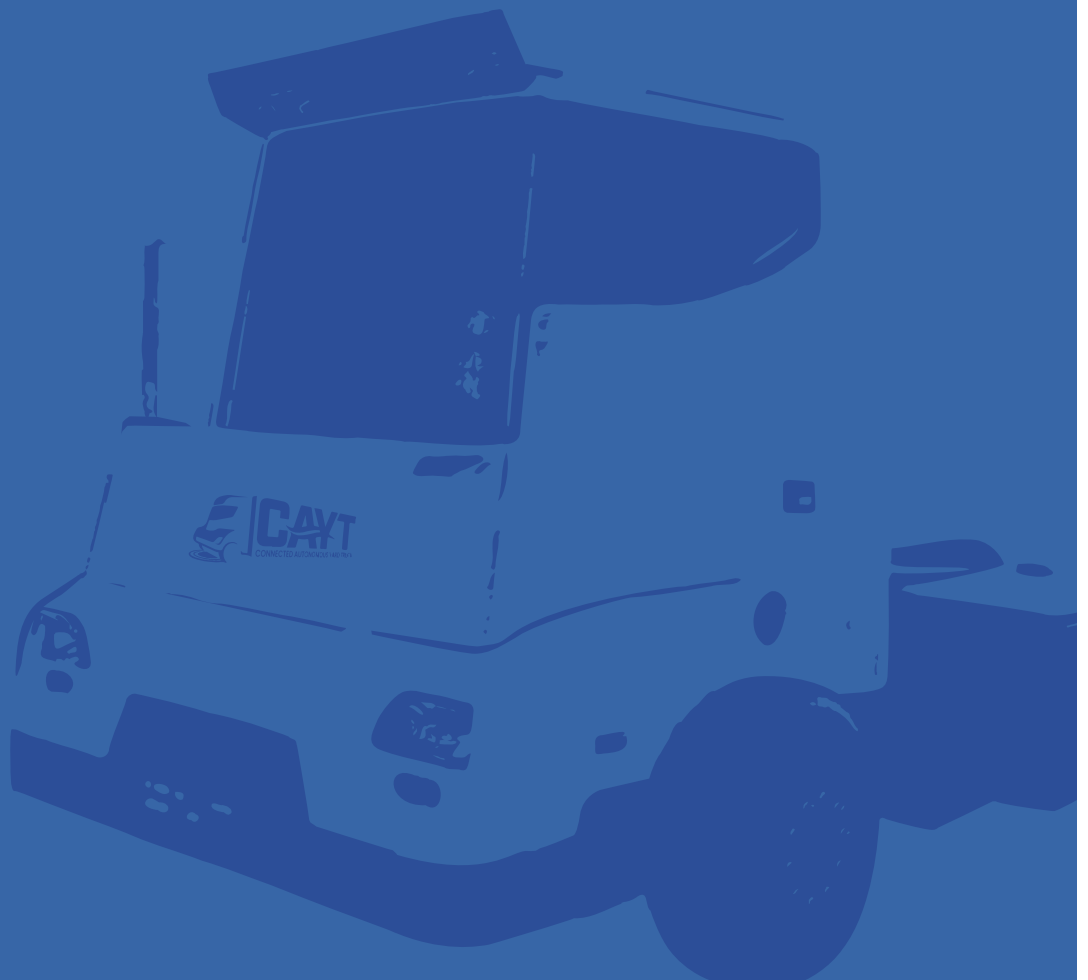




CAYT System Product Introduction



Business Overview



Our system enables the coexistence of human personnel and automated equipment within the port environment.

The CAYT system is a 'Connected Autonomous Yard Truck' and an 'Integrated Operations System' that autonomously transports containers by connecting with port terminal equipment and systems. Addressing the shortage of yard truck drivers, the CAYT system supplements the workforce, enabling both manned and unmanned yard trucks to coexist in the operational framework. By providing a safe and efficient cargo transportation solution, it enhances the **competitiveness** of ports.

Vision & Goal

Vision



Creating a proprietary technology brand



International Standards & Global Market Lead



Domestic Standards & Diffusion of Technologies



Promotion of Relevant Systems in Ports

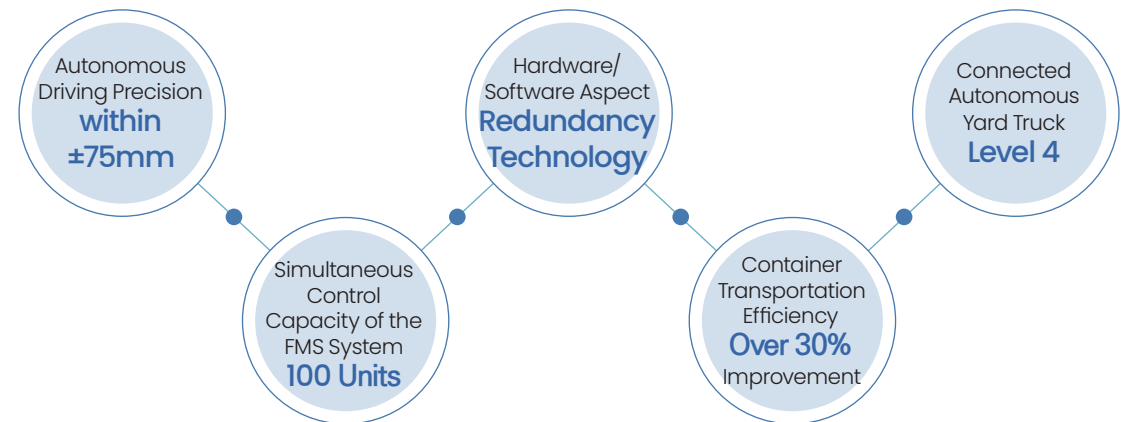


Reduction of On-site Safety Accidents

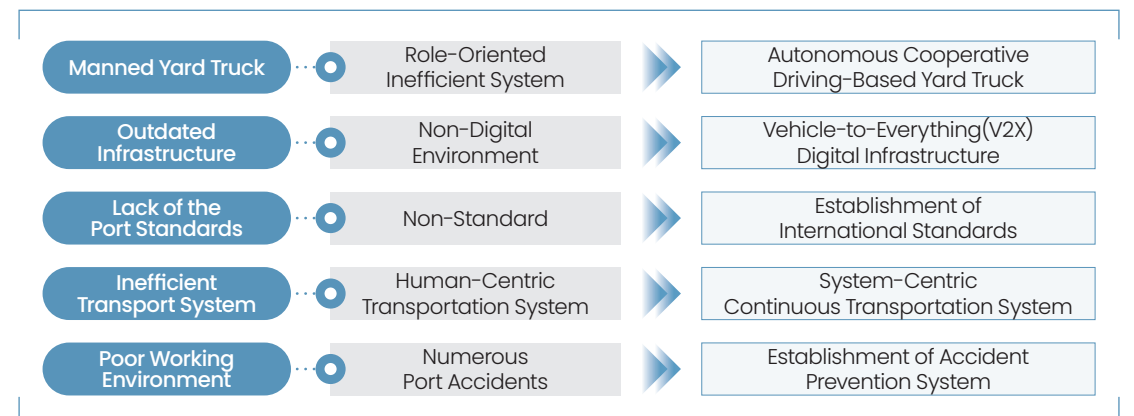


Enhancement of Work Quality for Port Workers

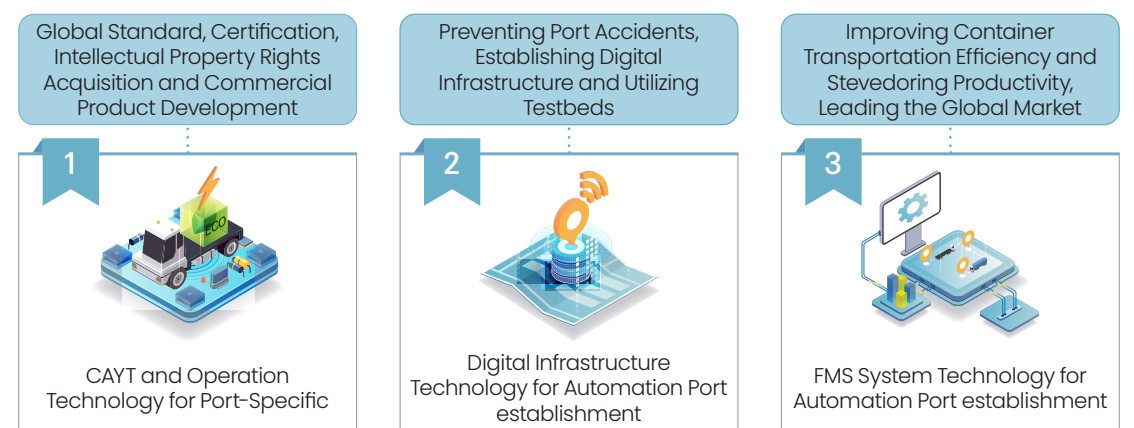
Goal



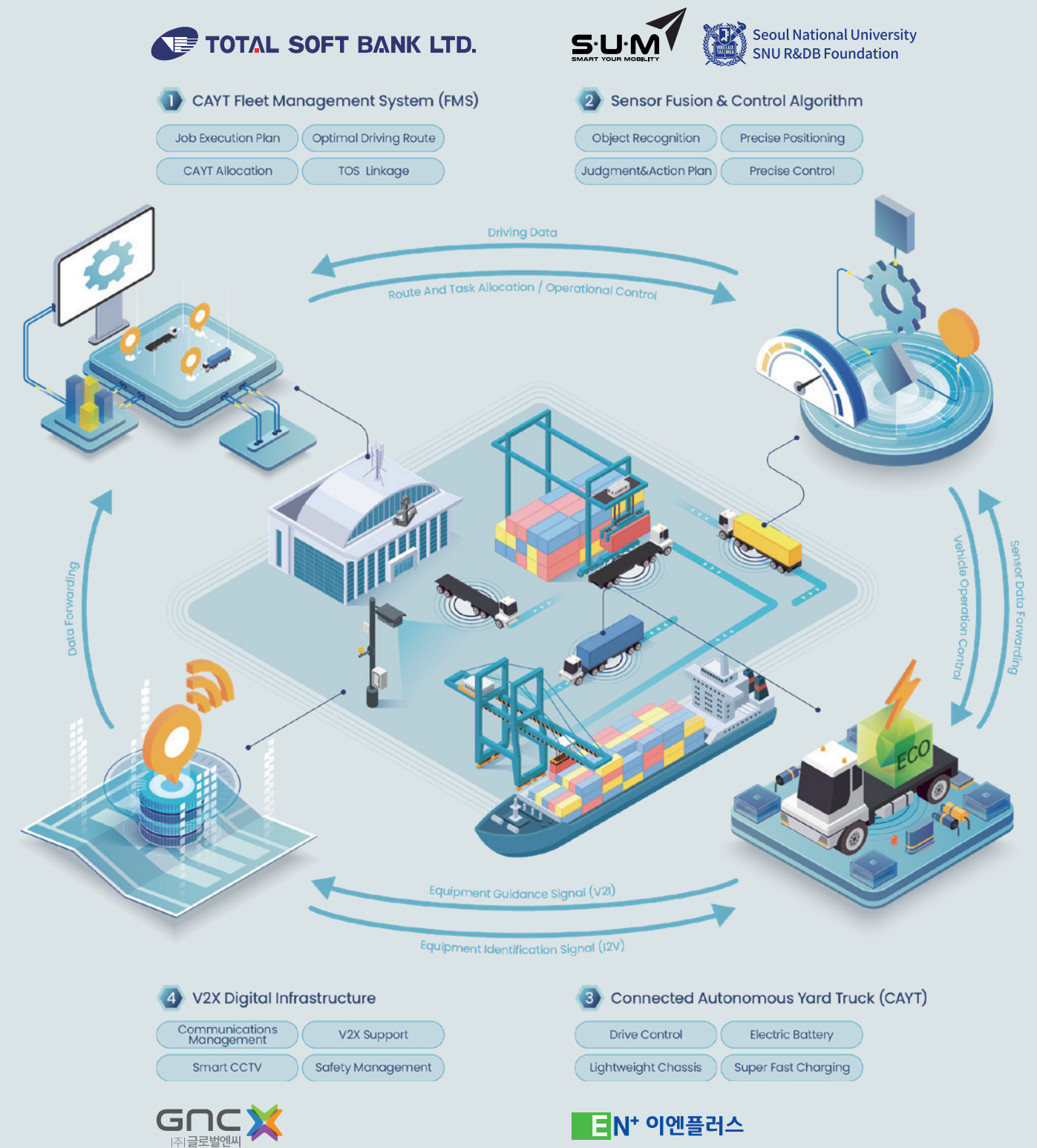
Direction



Strategy + Focus Area



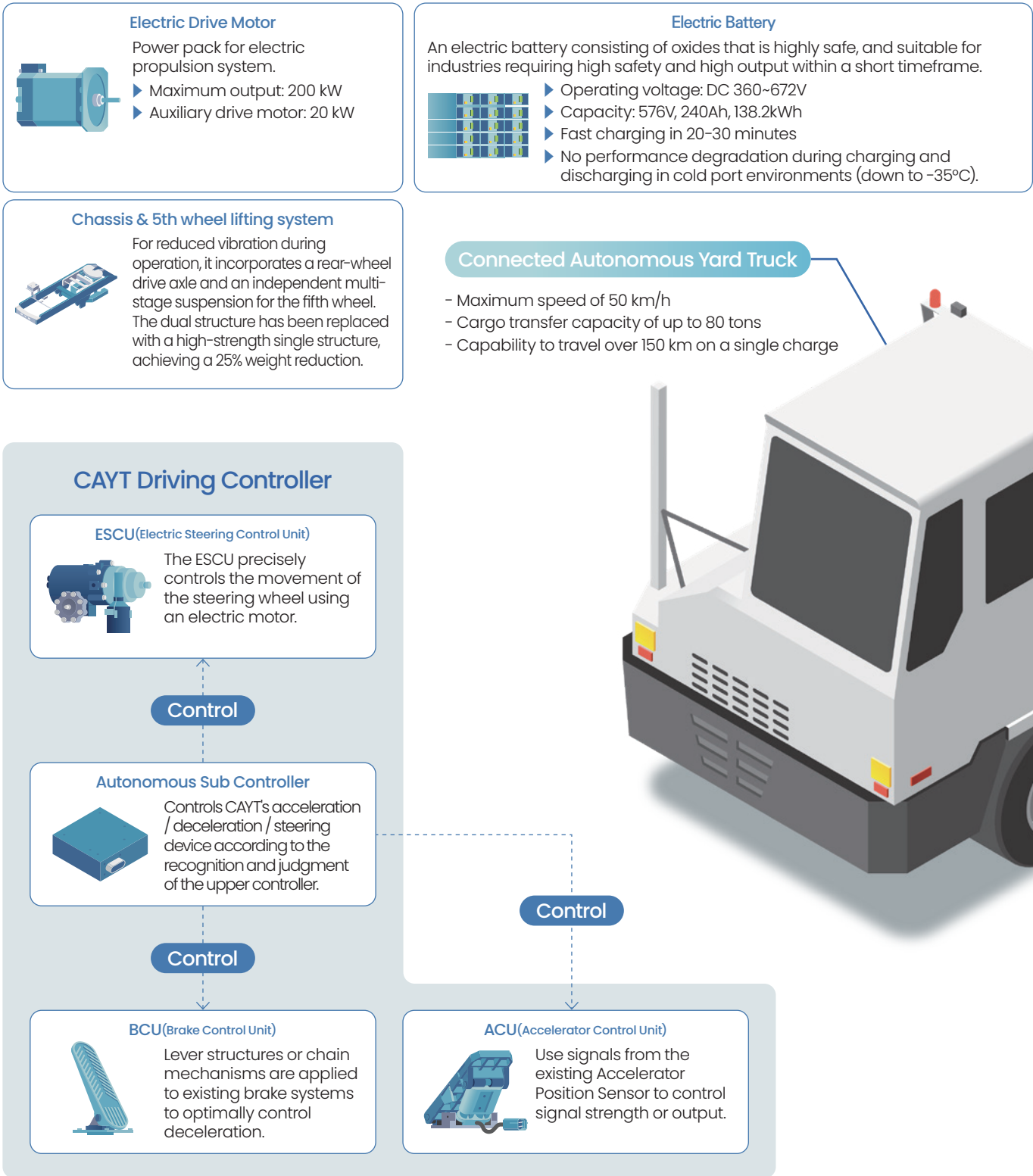
	AS-IS	TO-BE
Yard Truck	<p>Yard Truck Propulsion System</p> <ul style="list-style-type: none"> ▶ Environmental Issues Caused by Emissions from Aging Diesel Yard Trucks. ▶ Using lithium-ion batteries with performance/power limitations at low temperatures as the energy storage for electric yard trucks. 	<p>Electric Propulsion Battery</p> <ul style="list-style-type: none"> ▶ No performance degradation during charging and discharging in cold port environments (down to -35°C), and suitable for industries requiring high output in a short time.
Autonomous Driving	<p>Deficiency in Port Standard System</p> <ul style="list-style-type: none"> ▶ Various companies and relevant organizations are in the process of demonstrating technologies on car-only roads, urban roads, etc. ▶ Companies like Tesla are currently in the process of commercializing Level 3 autonomous driving technology, and they are also developing technology for the commercialization of Level 4. 	<p>Port-Specific Autonomous Cooperative Driving</p> <ul style="list-style-type: none"> ▶ Development of a port-specific autonomous cooperative driving cargo transport equipment by integrating existing autonomous driving and logistics transportation technology. ▶ Building operational scenarios tailored to diverse environments as a cornerstone for commercialization.
Digital Infra	<p>Deficiency in Port Standard System</p> <ul style="list-style-type: none"> ▶ Areas outside of automated zones experience safety accidents due to inadequate safety facilities. ▶ Absence of standardized integration system between equipment and systems within the port, resulting in limited benefits of digitization and automation. 	<p>Establishing Port Safety & Standardization</p> <ul style="list-style-type: none"> ▶ Safety systems such as Smart CCTV and UWB are introduced in the port to reduce safety accidents. ▶ Realization of port standardization by developing V2X message sets exclusively for ports and verifying services.
Fleet Management System	<p>AGV, AHT(YT)</p> <ul style="list-style-type: none"> ▶ TEAMS by TBA Co. improves operational efficiency by exploring routes to prevent deadlock and collision of AGVs. ▶ AHT scheduler by NAVIS Co. provides sub-second responsiveness, supports hundreds of CHEs, and reduces idle travel time by 10%. 	<p>AICBM, Digital Twin</p> <ul style="list-style-type: none"> ▶ Improve transport productivity by leveraging AICBM (AI, IoT, Cloud, Bigdata, Mobile) based operational and control technologies. ▶ Realization of unmanned cargo transportation during nighttime through IoT-AI-based digital twin and a 24-hour technical support system.



Connected Autonomous Yard Truck (CAYT)

ENPLUS Co., Ltd

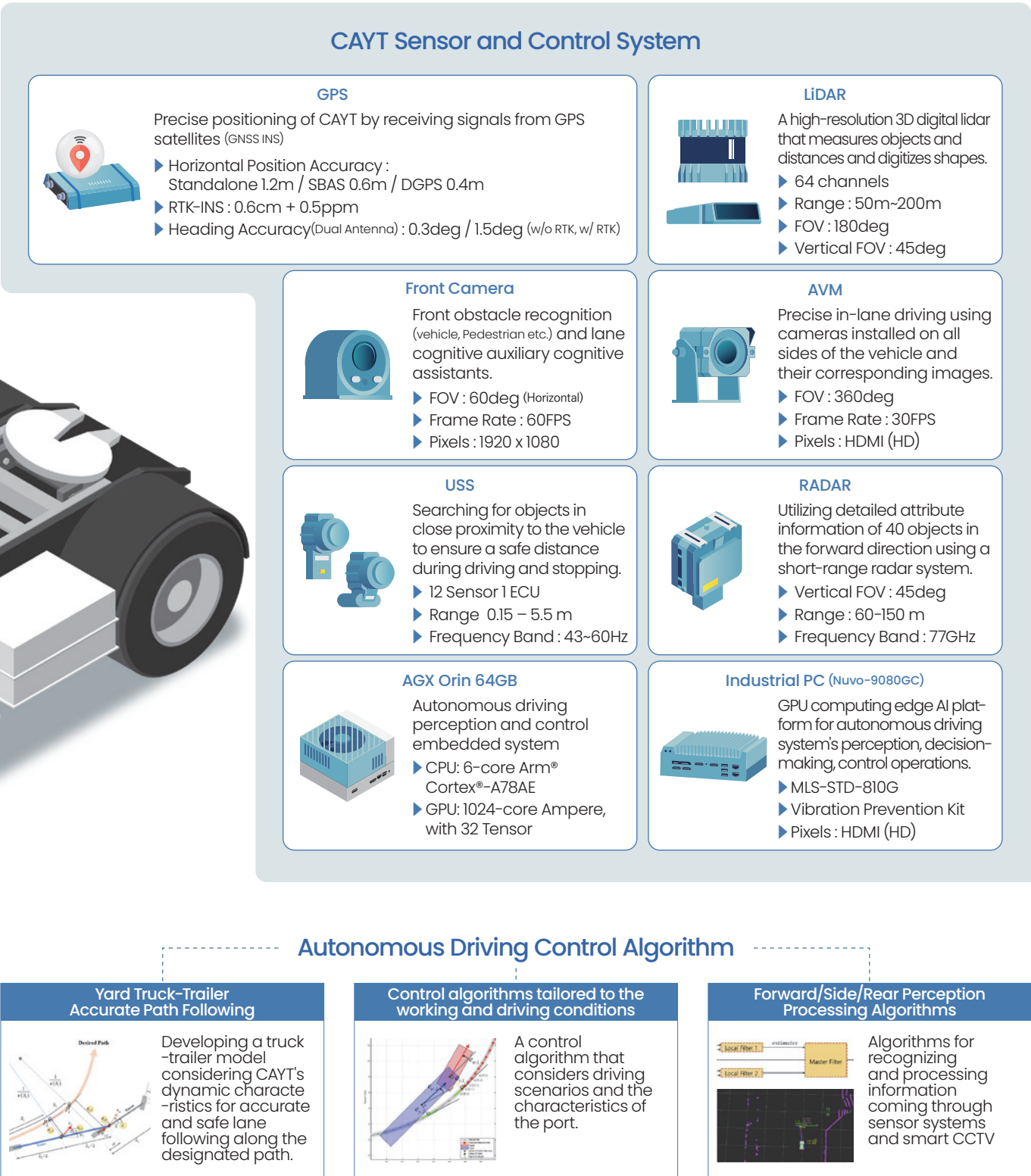
A yard truck that autonomously transports container cargo within the port, integrating with other equipment and systems.



Sensor Fusion & Control Algorithm

SUM LTD.
Seoul National University R&DB Foundation

Develop a sensor system and recognition · judgment · control technology minimizing blind spots in complex yard sections, and control algorithm that reflects the dynamic characteristics of yard trucks to implement precise driving of CAYT.

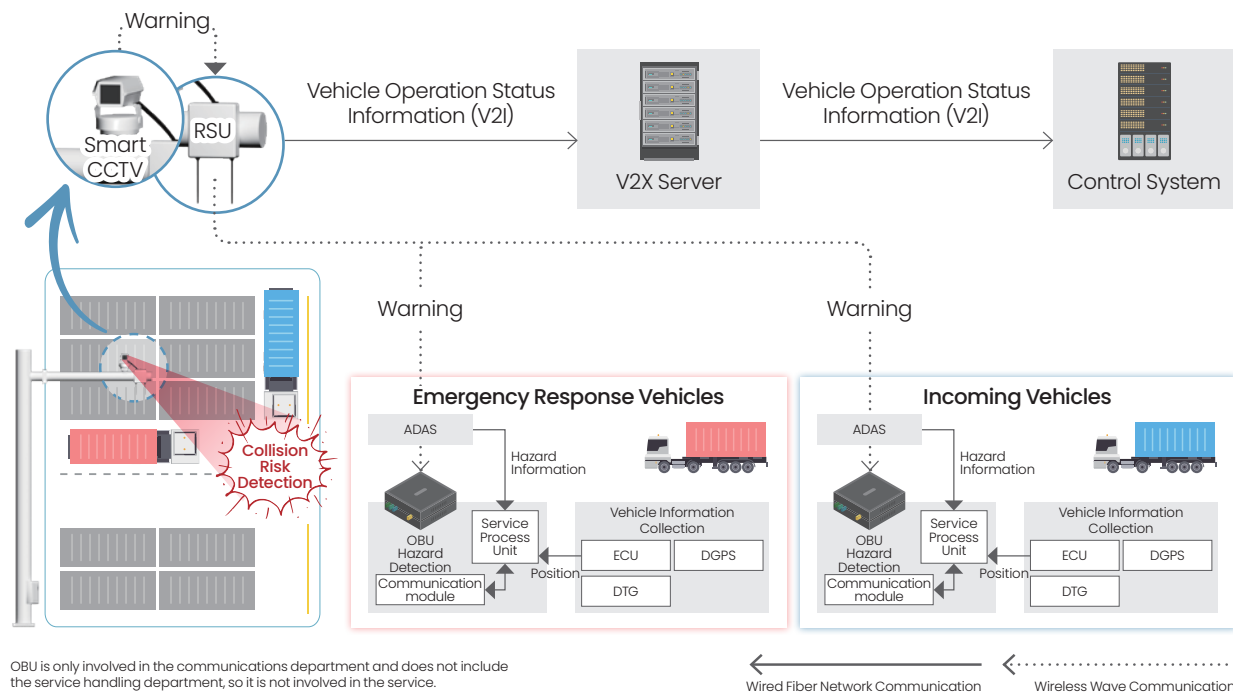


V2X Digital Infrastructure

Installing vehicle-to-everything (V2X) digital infrastructure such as communication equipment and smart CCTV to support the operation of CAYT within the port. Utilizing deep learning-based image analysis technology to gather and analyze various information from intersections, providing this data to on-site systems.

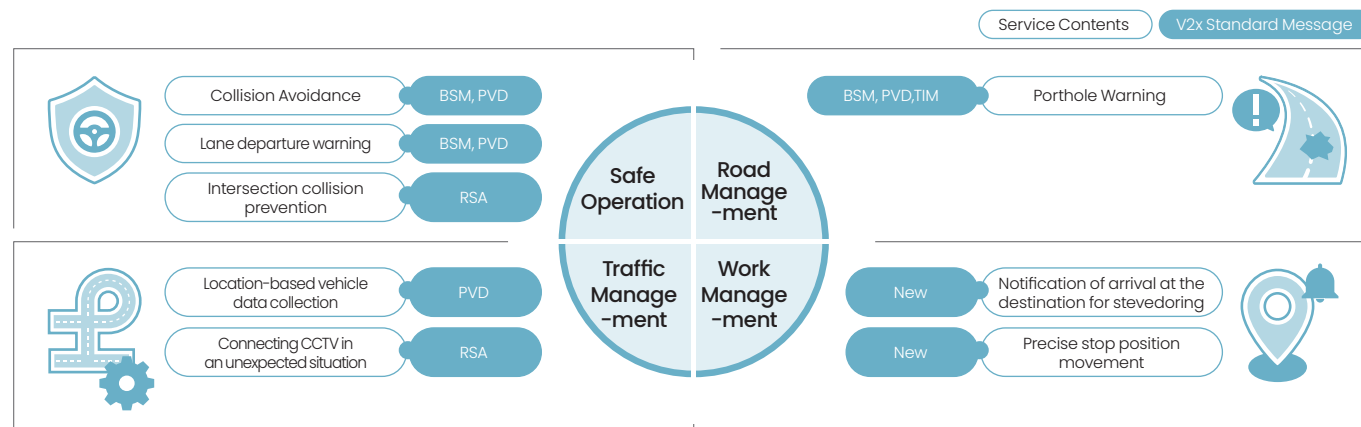
1. Congestion mitigation and accident prevention using RSU, OBU, smart CCTV

- ▶ Reduce congestion by transmitting congestion information to the control system using deep learning-based object analysis using artificial intelligence of smart CCTV
- ▶ In the event of dangerous situations such as possible collisions (vehicle-vehicle, vehicle-worker) at the intersection, information is communicated to the vehicle terminal (OBU) to prevent accidents



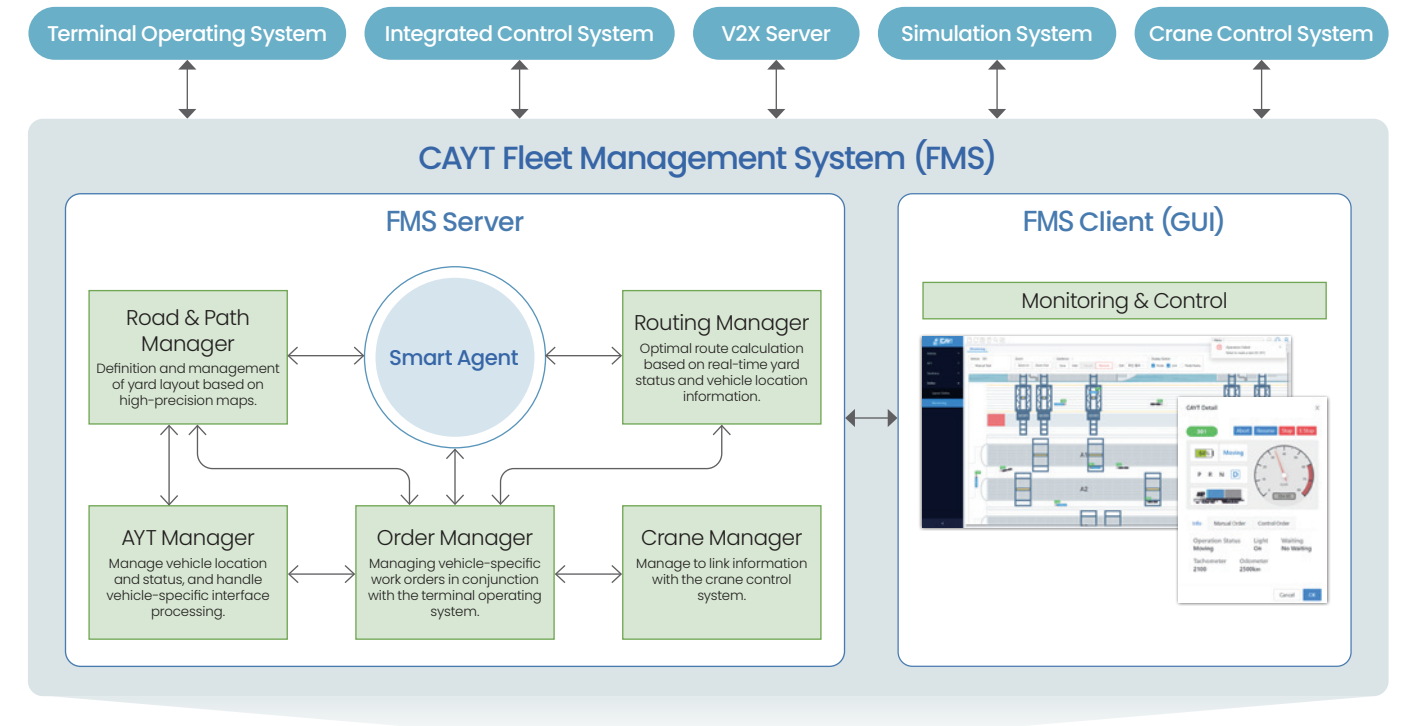
2. Warning and Assistance Services

- ▶ Collecting real-time information on unexpected events such as accidents, breakdowns, obstacles, as well as abrupt stops and rapid decelerations, and transmitting warning messages to nearby CAYTs and the control system.
- ▶ Providing driving information of maintenance and emergency vehicles to the surrounding vehicles to prioritize their movement.

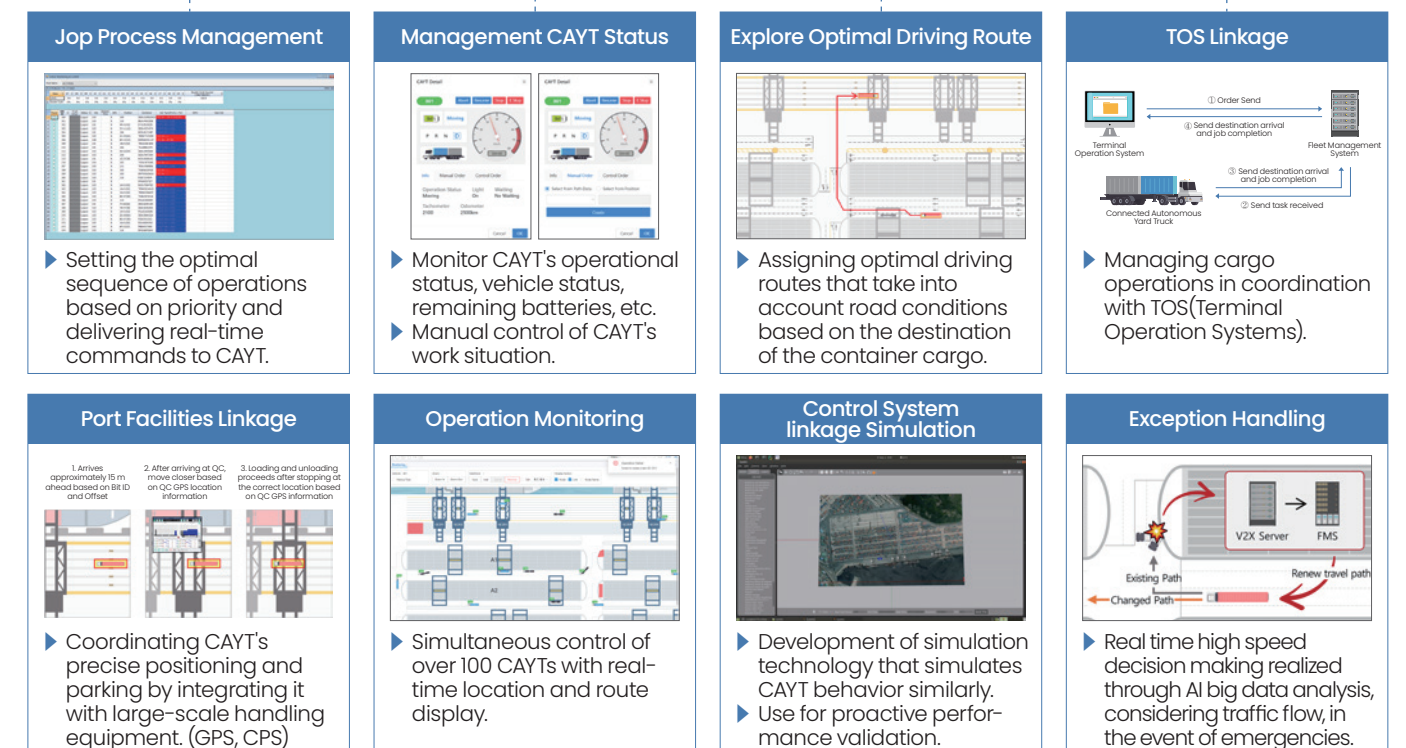


CAYT Fleet Management System

An operation control system that supports and manages the optimal driving of CAYT by integrating with various systems within port.
(* Terminal Operating System (TOS), Integrated Control System, Simulation System, etc.)



-- Main Function





- ▶ Through CAYT, we ensure business continuity and achieve fully automated port operations with competitive pricing.
- ▶ Utilizing Fourth Industrial Revolution technologies such as IoT, digital infrastructure, and artificial intelligence, we realize customer satisfaction through user-centric services for external users.
- ▶ Address the issue of manpower supply and demand resulting from the reluctance to engage in field work, and transition from a labor-intensive industry to a technology-intensive one.



- ▶ Enhancing operational punctuality by integrating internal and external systems within the port using Fourth Industrial Revolution technologies.
- ▶ Increase productivity by replacing the fatigue-intensive tasks avoided by manned yard trucks with CAYTs and distributing them flexibly.
- ▶ By maintaining the existing facilities of the port and establishing a working system where both manned and unmanned yard trucks coexist, we achieve the sustainability of the port.



- ▶ A worker-friendly solution that replaces the shortage of yard truck drivers with CAYT to realize a work system where manned and unmanned yard trucks coexist and improve the quality of work.
- ▶ By establishing operational policies that permit autonomous driving in situations where safety is assured for stevedoring operations and on-site workers, we achieve a secure port.
- ▶ To prevent safety incidents by utilizing AI perception and analysis technology to respond to and improve unforeseen sudden situations.



- ▶ Through real-time data and artificial intelligence-driven smart route planning and efficient driving patterns, unnecessary fuel consumption is reduced, minimizing environmental impact.
- ▶ By replacing fossil fuels in conventional diesel yard trucks with electric energy, we reduce the emission of harmful substances in the atmosphere and maximize energy efficiency.
- ▶ CAYT electric battery's long lifespan makes maintenance easy and prevents environmental pollution that occurs during the recycling process of lead-acid batteries.



WWW.CAYT.AI



Independent Research Institution | TOTAL SOFT BANK LTD.



☎ +82 70 4733 1000 🏠 www.tsb.co.kr ✉ inquiry@cayt.ai



Collaborative Research Institution

ENPLUS Co., Ltd



SUM LTD.



Seoul National University R&DB Foundation



GLOBAL NC LTD.



Incheon Port Authority



Jeonbuk Institute of Automotive convergence Technology



SMLine Gyeong-In Terminal



This research was supported by the Korea Institute of Marine Science & Technology Promotion(KIMST) funded by the Ministry of Oceans and Fisheries, Korea(20220583).

Copyright © 2023 Total Soft Bank Ltd. All Rights Reserved.

This publication is copyright and may not be reproduced in whole or in part without permission of the publisher.