Development of autonomous driving platform for vehicle-type logistics robot "FAEV"

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Abstract

The global logistics and transportation industry is increasingly demanding to introduce eco-friendly transportation mobility due to climate change response, aging population, and shortage of working manpower. Based on the 4th industrial revolution technology, it is rapidly developing with the spread of smart factories and the advancement of logistics and transportation. In particular, due to the increasing demand for autonomous delivery robots capable of non-face-to-face logistics transport due to the impact of COVID-19, various robot products are being supplied. In this study, we introduce the autonomous driving platform technology of a vehicle-type logistics robot that can efficiently respond to various changes in the work environment at the manufacturing site and can be fused with future ICT technologies.

Key Words : Transportation Robot, EV, ICT, Sensor System, Autonomous Driving, Manned and Unmanned Driving Paltform.

Ⅰ. INTRODUCTION

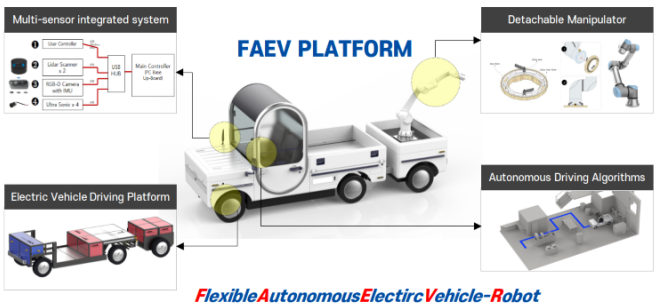
The global logistics and transportation field is going through a non-face-to-face era where human contact activities are restricted due to COVID-19, and is facing a change in innovation beyond just improvement. Most logistics companies have not established a countermeasure for labor shortage and productivity improvement due to shortage of labor, aging of labor, enforcement of severe disaster punishment regulations, and increasing demands for ESG management.

The automation used in the logistics industry is divided into AGV (Automatic Guided Vehicle) and AMR (Autonomous Mobile Robot) according to the driving method [1]. The conventional AGV, which drivesthrough a magnetic guideline or marker on the ground, there are limitations in usability. There is other research for an autonomous vehicle of AMR with the same platform. An autonomous driving vehicle in the form of AMR type using LiDAR and an image sensor was developed [2].

In this study, we introduce the FAEV, an electric vehicle-type autonomous driving robot platform of a future-oriented transport robot that can automate simple and repetitive tasks of non-face-to-face logistics transport, high-load logistics, simplification of logistics processes, securing safety of logistics and transport, and collaboration with humans.[1]

Ⅱ. MAIN BODY

This study is a technology that can change the manned electric vehicle, which is currently widely used in the logistics and transportation industry, into an autonomous vehicle. In particular, in large-scale industrial complexes and logistics centers, it is a technology for developing a driving platform for transport robots that can freely move between buildings, inside and outside buildings, and carry out logistics. It is a driving platform that can maximize logistics efficiency by driving at high speed when driving outside and at a safe speed when driving indoors. Ultimately, the goal is to flexibly switch between manned and unmanned driving, and to develop the `technology to secure the source technology of the driving platform technology that can realize the current collaborative work environment with humans and prepare for the future unmanned work environment at the same time.[3]

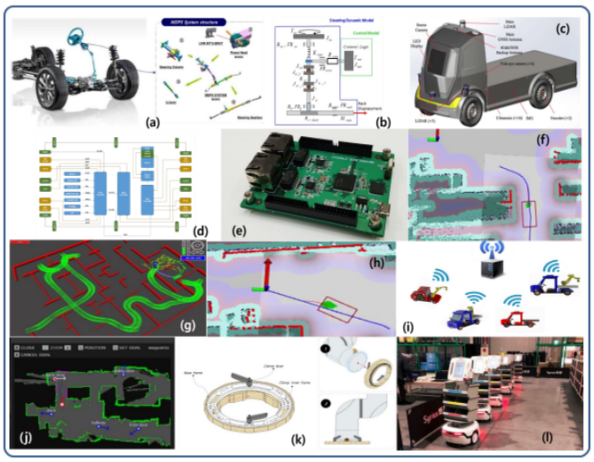


[Fig.1] Paltform of FAEV

In Fig.1, the FAEV Robot is a driving platform that adds an autonomous driving system such as a camera, lidar, ultrasonic wave, and automatic steering system to an existing electric vehicle. This platform has an integrated module technology that integrates sensor signals, a control technology that recognizes and detects the robot's position and surrounding environment with lidar and a camera, and ultrasonic waves to prevent obstacles that may not be detected by other sensors or unexpected collisions. Based on control technology, it

is a robot that realizes automatic map generation of driving routes and optimal route driving.

Operation of multiple robots and interworking of various tasks, software download and control system interlocking functions in various communication environments for efficient operation and management, development of advanced recognition and avoidance algorithms for various obstacles, detachable structure for mounting a mobile picking robot arm in a vehicle, and We continue to advance the platform by developing control systems, standardizing communication methods for controlling communication with all controllers, and building real-time control and monitoring systems.



[Fig. 2] Configuration of autonomous driving system

(a) automatic steering system, (b)MDPS control algorithm, (c) multi-sensor system, (d) multi-sensor module configuration, (e) high-speed communication main board, (f) map generation and location recognition, (g) AI Algorithm-based path generation, (h) obstacle avoidance using local planner, (i) multi-platform operation management, (j) user interface program, (k) robot arm interface, (l) test bed operation experiment

Ⅲ. CONCLUSION

FAEV, an electric vehicle-type autonomous driving robot developed in this study, is configured to enable optimal logistics transport in indoor as well as outdoor environments in various industries. It is designed to enable various types of logistics transport and ICT technology convergence.

Furthermore, the manned and unmanned switching modes will realize collaborative work between workers and robots, and will expand to enable fully automatic transport work linked to mobile picking robots.

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(Development of a self-driving electric vehicle platform that can be switched with or without an integrated logistics robot, task number 171134144)

REFERENCES

[1] S. Y. Hwang and K. S. Roh, "Industrial logistics transport robot driving technology," Journal of the Korea Society of Mechanical Engineers, 5thed. vol. 59, no. 59, 2019, pp. 27 - 31.

[2] J. Toledo, J. D. Piñeiro, R. Arnay, D. Acosta, and L. Acosta, " Improving odometric accuracy for an autonomous electric cart". Sensors, vol. 18, no. 1, 2018, pp. 200-214.

[3] K. W. Jeon, E. J. Jung, S. H. Park. (2021). Development of Autonomous Electric Vehicle for Logistics Robot. Proceedings of the KSMPE Conference, (), 96-96.