Environment recognition technologies for off-road self-driving with improved real-time processing performance

April 17 2024

Researcher Han-Min Lee of the KIMM is giving an explanation of the research outcome related to the newly developed technologies. Credit: Korea Institute of Machinery and Materials (KIMM)

Off-road environment recognition technologies for detecting extraneous substances such as dust, mud, snow, or rain during off-road autonomous driving of construction machinery, agricultural machines, and unmanned ground vehicles (UGVs) and removing the sensor signals of these substances on a real-time basis, have been developed for the first time in Korea.

It is expected that these newly developed technologies will be applied in the future to industrial machinery such as excavators, dump trucks, and search vehicles and also to military self-driving cars, and will provide workers with a safe working environment.

The research team led by Senior Researcher Han-Min Lee of the Department of Industrial Machinery DX under the Virtual Engineering Platform Research Division of the Korea Institute of Machinery and Materials has developed off-road environment recognition technologies for driving in off-road environments such as mountainous, waterside, or snowy regions, including sensor protection and cleaning technology, sensor signal correction technology, and drivable area recognition technology, and has transferred these technologies to relevant corporations.

Among the off-road environment recognition technologies that the KIMM has newly developed, the "sensor protection and cleaning module" technologies can be used for spraying detergents on muddy water or mud that may splash onto the sensor during off-road self-driving and wiping them away in real-time by using a wiper, thereby almost completely removing the contaminants.

In addition, the "sensor signal correction" technology for removing small-sized extraneous substances such as dust, snow, and rain that can be generated during driving can help to maintain off-road self-driving conditions more stably, even under unstructured environmental

conditions like bad weather.

Additionally, the "drivable area estimation technology" developed by the KIMM can be used to detect general obstacles as well as steep slopes, potholes, and bumpy roads and automatically identify alternative routes to avoid those obstacles, which can help to prevent the machinery or vehicle from colliding with other objects.

Moreover, the KIMM has also developed the "driving control technology" for controlling the driving of a vehicle on a real-time basis by selecting, among the various technologies described above, only the functions that are needed.

Previously, there has been no sensor protection technology suitable for off-road environments where dirt and mud adhere to vehicles, nor a technology capable of removing the sensor signals of extraneous substances like dust, snow, or rain on a real-time basis when these substances are included in LiDAR or camera sensor signals.

Moreover, there also has been a lack of real-time drivable area estimation technologies capable of recognizing not only bumpy obstacles such as trees and rocks but also hollow obstacles like cliffs and pits.

On the other hand, the newly developed off-road environment recognition technologies have improved processing speed by more than 1.5 times while maintaining key performance indicators such as sensor contamination recovery rate, sensor noise removal accuracy, and off-road drivable driving area estimation accuracy at a level equal to or higher than that of existing technologies, paving the way for these technologies to be practically used for controlling off-road self-driving.

Senior Researcher Han-Min Lee of the KIMM said, "These are technologies for resolving the issue of environment recognition, which

can be a dangerous obstacle during off-road autonomous driving."

Lee added, "We will make all-out efforts so that the technologies that we have newly developed can be applied not only to the self-driving of industrial machinery such as excavators, dump trucks, and tractors but also to the autonomous driving of unmanned military vehicles like tanks and search vehicles."

Provided by National Research Council of Science and Technology

Citation: Environment recognition technologies for off-road self-driving with improved real-time processing performance (2024, April 17) retrieved 17 May 2024 from https://techxplore.com/news/2024-04-environment-recognition-technologies-road-real.html