KOREA INSTITUTE OF MACHINERY & MATERIALS	**Press Release**	

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PR Department : Ms. Jihyeon Seo, Team Leader, Dept. of External Relations (+82-42-868-7329, san@kimm.re.kr)

Researcher : Dr. Moohyun Cha, Principal Researcher, Dept. of Smart Industrial Machine Technologies (+82-42-868-7927, mhcha@kimm.re.kr)

KIMM develops the VR-based virtual test and control technology for unmanned working vehicles

- VR technology to enhance safety and reliability of unmanned operations -

- Expected to usher in era of automation, including smart construction and smart farming -

☐ The Korea Institute of Machinery & Materials (KIMM; President Sang Jin Park) under the Ministry of Science and ICT developed a virtual test and control technology for unmanned working vehicles to accelerate the automation of various industrial machines using VR.

☐ Unmanned technology has been in demand for industrial working vehicles, which are usually used under extreme conditions in industries such as agriculture and construction. However, the development of unmanned systems has been limited due to the diverse operational scenarios and constraints in terms of safety and cost.

□ The team led by Moohyun Cha, principal researcher of the Department of Smart Industrial Machine Technologies at KIMM, developed a VR-based virtual test and control technology for unmanned working vehicles in partnership with LS Mtron, a Korean company specializing in agricultural machines. The proposed technology allows unmanned agricultural machines to be tested in virtual scenarios, and supports long-distance control of unmanned operations.

□ When a user designates a path based on location information of a satellite map, unmanned operations can be simulated in the 3D virtual environment. The system tests key indicators of unmanned performance, including environment detection and path control, and shows promise as a substitute for actual field tests.

□ In particular, the self-driving control algorithm is capable of conducting more realistic tests as it reflects specific operational features of large machines, including hydraulic actuator delay.

□ When applied to actual unmanned working vehicles, the system supports remote control of cameras and vehicle control using mobile devices. More efficient and centralized control is possible even in operations involving multiple vehicles, such as in smart farming and smart construction. In addition, all processes can be monitored in real time through synchronization of all sensor data obtained from actual unmanned vehicles.

□ Developed solely from open-source technology, the proposed technology is expected to contribute to the development of unmanned systems for not only agricultural tractors, but also various industrial machines. Technology transfer has been completed to LS Mtron, which plans to utilize it in the development of large automated tractors and smart farm services.

□ Principal researcher Moohyun Cha said, “There has been a growing demand for safer and more reliable industrial machines, in addition to the need for automation. The diverse, complicated scenarios available for virtual tests allow greater accumulation of data, which will help to save time and cost involved in the development and testing of unmanned systems.”

□ The study was conducted as part of the “Development of Industrial Off-road Working System Technologies Supporting Autonomous Operations” supported by the Ministry of Science and ICT. The proposed technology received the Science and ICT Ministerial Prize (grand prize) in the 2020 Digital Transformation Competition organized by the Society for Computational Design and Engineering (CDE).

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- Attachment 1: VR-based unmanned working vehicle virtual test simulation (photo)
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The Korea Institute of Machinery and Materials (KIMM) is a non-profit government-funded research institute under the Ministry of Science and ICT. Since its foundation in 1976, KIMM is contributing to economic growth of the nation by performing R&D on key technologies in machinery and materials, conducting reliability test evaluation, and commercializing the developed products and technologies.

Credit : The Korea Institute of Machinery and Materials (KIMM)
Usage Restrictions of Multimedia (Attachment File) : The sources of photos and research results from KIMM must be specified.

- Attachment 1: VR-based unmanned working vehicle virtual test simulation (photo)

Photo description: The virtual test software for unmanned working vehicles developed by KIMM (left) and virtual testing using an actual unmanned tractor (right). With KIMM's VR-based unmanned working vehicle virtual test and control technology, unmanned vehicles can be tested on various paths and under different scenarios before real-world operation.

- Attachment 2: VR-based unmanned working vehicle video 3D-based control (photo)

Photo description: Remote video control using KIMM's VR-based unmanned working vehicle virtual test and control technology (left), and monitoring of task execution by the tractor in the 3D software (right). With KIMM's VR-based unmanned working vehicle virtual test and control technology, the user can perform virtual tests to determine whether the machine works as desired in outdoor environments.

- Attachment 3: Physical working vehicle test using virtual test results and immersive control system (photo)

Photo description: Unmanned tractor at work using KIMM's VR-based unmanned working vehicle virtual test and control technology (left), and remote operation by a user wearing a head-mounted display (HMD). With KIMM's VR-based unmanned working vehicle virtual test and control technology, unmanned operations can be performed using pre-designed algorithms, and effective integrated control is enabled through real-time monitoring of results.

- Attachment 4: Introduction of KIMM's Department of Smart Industrial Machine Technologies

The Department of Smart Industrial Machine Technologies under the Mechanical Systems Safety Research Division at KIMM (Hanmin Lee, principal researcher, +82-42-868-7812, hmlee@kimm.re.kr) conducts research to apply 4IR technology across industries.

In addition to agricultural machines, the department is developing core technology for the automation of not only agricultural machines, but also construction machines such as excavators and cranes, special mission equipment for national defense, and various off-road industrial machines including land-air unmanned vehicles. Recent projects include ▲ Development of High-reliability 250-ton All-terrain Crane With AI Safety and Driver Convenience Features (Ministry of Trade, Industry and Energy, 2018-2022), ▲ Development of Unmanned Ground Vehicle for Uneven Terrain to Perform Land/Sea/Air Cooperative Missions (Ministry of Science and ICT, 2020-2027), ▲ Development of Unmanned Ground Vehicle for Unmanned Deliveries in Urban Environments (Ministry of Science and ICT, 2020-2027), and ▲ Development of Technology for Unmanned Snow Removal on Runways (Defense Acquisition Program Administration, 2019-2022).