Gwangju Institute of Science and Technology

Official Press Release (https://www.gist.ac.kr/)

Professor Sun-Kyu Lee's research team develops a robotic arm for molding the shape of autonomous vehicles

☐ GIST (President Kiseon Kim) School of Mechanical Engineering Professor Sun-Kyu Lee's research team has developed a robotic arm that can complete the finishing process of molding the shape of vehicles, which is currently mostly done by hand.

◦ The research results are expected to significantly shorten the development period and cost of various autonomous cars in the era of the 4th Industrial Revolution.

☐ In the era of autonomous vehicles, it is expected that new cars of various models will emerge in a very short cycles, depending on various business models. The final process of the body mold, which determines the exterior design of the car, is mostly made by skilled workers, making it the most expensive and time-consuming stage in making a new vehicle.

☐ The mold finishing process involves removing the tool marks left from previous steps and then correcting the shape of the mold from the stamping process (a method of printing out the uneven shapes onto sheet metal). This process is repeated dozens of times. Automakers consider this the most important task, and many domestic and foreign research institutes have tried to develop manufacturing technology, but it has been difficult to develop a device that has satisfactory performance.

☐ Professor Sun-Kyu Lee's research team succeeded in obtaining satisfactory surface condition by strengthening the joint stiffness of the robotic arm with a special design and by controlling the robotic arm safely with a small amount of power to for precision results.

- These modifications can be installed and operated on large machines that are widely used at industrial sites, so it is possible to utilize the machine tools as they are. This is expected to reduce the manufacturing time and cost for medium and large molds by more than 50%.

☐ In the mold finishing process, evaluating the surface is carried out by visual and tactile inspection of workers. To replace the lapping operation with automation, the status of the surface must be evaluated in real time to determine the progress of the operation.

- Artificial intelligence (AI) image processing techniques that simulates the cognitive process of skilled workers is being developed to evaluate the presence of tool and scratch marks on the machined surface.

- In particular, in the mold manufacturing field, mechanical and software development must be followed to realize to automatically switch the grinding tools of various sizes and to precisely control the force for each tool to enable the machining of complicated shapes.

☐ Professor Lee's research team expects that this technology can be applied to finishing large and medium metal and non-metal products made by 3D printing, casting, welding, etc., and will play a big role in smart factories in the 4th Industrial Revolution era.

☐ Professor Sun-Kyu Lee said, "The research results are expected to play a role in securing international competitiveness in the parts and equipment sector, which is expected to be difficult due to the recent tightening of export regulations by the Japanese government. Especially in the era of autonomous vehicles, this will contribute to greatly reducing the development period and cost of various new cars."

- This research was performed for more than four years (August 2015 ~ present) with support from the National Research Foundation of Korea and the GIST Institute of Integrated Technology.

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