



Enhancing Efficiency of Robotic Arms through Software-Driven Platforms

Increasingly sophisticated manufacturing processes as well as intelligentization trends in agriculture and service industries have become major drivers of market demand for robotic arms. According to the Robotic Arms Market Research Report Forecast by Global Information Inc. (GII), the global market size for robotic arms is expected to reach \$55.4 billion by 2032, with applications extending beyond traditional manufacturing plants to sectors such as warehouse logistics, construction, smart cities, healthcare, and agriculture.

PC-based controllers: 3 key technological trends

The diversification of applications is driving a paradigm shift in robotic arm controller architecture from traditional single-chip control to PC-based controllers. This shift addresses three main requirements: motion control, high-precision control, and data acquisition.

First, the shift to software-based motion control reduces development costs and enhances future expansion flexibility. Given that the tasks a robotic arm can perform are limited by the number of axes it operates on, increasing this number can allow for them to perform more complex and diverse tasks. Traditionally, PC-based controllers integrate the motion control card architecture. As the number of axes increases, the cost of motion control cards rises accordingly. At present, software is being used to replace motion control

cards, with computer resources leveraged to control the robotic arm's motion. This approach effectively reduces development costs and increases flexibility for future expansion.

Second, software-driven control enhances the precision of calculations. Robotic arms require high-precision control to ensure they can perform the appropriate movement at the right time. This not only requires precise movements with error tolerances within a few millimeters, but they must also be prompt or even instantaneous.

Traditional single-chip controllers issue control commands via firmware, while for PC-based controllers, real-time operations are utilized to develop different control interfaces.