



Non-Conventional Robotics Technology Applications in the Food Industry

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DESCRIPTION

The food industry is undergoing a transformation driven by the integration of advanced technologies. Among these, non-conventional robotics technology stands out for its innovative applications, addressing challenges from food safety to operational efficiency. Different traditional manufacturing, which focuses on repetitive tasks in controlled environments, non-conventional robotics technology brings versatility, adaptability, and intelligence to diverse and dynamic food production settings. This article explores the groundbreaking ways these technologies are being deployed in the food industry.

Precision agriculture and harvesting

Non-conventional robotics technology has made significant strides in precision agriculture, enhancing the efficiency and sustainability of food production. Autonomous robots equipped with advanced sensors, machine learning algorithms, and GPS technology are now used to monitor crop health, soil conditions, and weather patterns. These robots can make real-time decisions about watering, fertilizing, and pest control, optimizing the use of resources and minimizing environmental impact. Harvesting robots represent another leap forward. Traditional methods often rely on manual labor, which is time-consuming and inconsistent. In contrast, robots like the ones developed by companies such as Iron Ox and Root AI use sophisticated vision systems and AI to identify and pick ripe fruits and vegetables with precision and care, reducing waste and ensuring higher quality produce.

Food processing and packaging

In food processing and packaging, non-conventional robotics technology addresses the need for speed, hygiene, and flexibility. Cobots, or collaborative robots, work alongside human workers, enhancing productivity and safety. Unlike traditional industrial robots that require isolated workspaces, cobots are designed to operate safely in close proximity to humans. They can perform tasks such as sorting, cutting, and assembling with high accuracy,

adapting to various product types and packaging requirements. For instance, Soft Robotics Inc. has developed robotic grippers that mimic the dexterity and gentleness of a human hand, allowing them to handle delicate items like fruits, pastries, and ready-to-eat meals without causing damage. These robots can quickly switch between different tasks and products, making them ideal for environments with high variability and short product cycles.

Quality control and food safety

Ensuring food safety and quality is paramount in the food industry, and non-conventional robotics technology plays a crucial role in this domain. Traditional quality control methods often involve manual inspection, which can be subjective and error-prone. Robotics technology, however, offers a more reliable and efficient alternative. Vision systems powered by AI are used to inspect food products for defects, contaminants, and inconsistencies. These systems can analyze visual data at high speeds, identifying issues that might be missed by the human eye. For example, robotics technology is employed to check the size, color, and surface texture of fruits and vegetables, ensuring that only those meeting strict quality standards reach consumers. Moreover, robots equipped with sensors can detect pathogens and chemical residues, enhancing food safety. By integrating these robots into the production line, companies can achieve real-time monitoring and rapid response to potential hazards, significantly reducing the risk of foodborne illnesses.

Automation in food service and delivery

The food service industry is also benefiting from non-conventional robotics technology, particularly in response to the growing demand for efficiency and contactless interactions. Robots are now used in kitchens to prepare meals with consistent quality and speed. For example, robotic chefs like those developed by Moley Robotics can perform a wide range of cooking tasks, from chopping ingredients to plating dishes, all while maintaining high hygiene standards. In the area of food delivery, autonomous vehicles and drones are revolutionizing

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last-mile logistics. Companies like Starship Technologies and Manna Aero are deploying delivery robots that navigate through urban environments to deliver food orders directly to customers' doorsteps. These robots reduce the need for human couriers, lower delivery costs, and provide a contactless experience, which has become particularly important in the context of the COVID-19 pandemic.

Despite the numerous advantages, the adoption of non-conventional robotics technology in the food industry is not without challenges. High initial costs, technological complexity, and resistance to change are significant barriers. Small And Medium-Sized Enterprises (SMEs) may find it particularly difficult to invest in and integrate these advanced systems. However, as technology continues to advance and become more accessible, these barriers are expected to diminish. The development of affordable and user-friendly robotic solutions tailored to the needs of SMEs will drive wider adoption. Additionally, ongoing research and innovation are likely to produce even more sophisticated robots capable of handling

complex tasks with greater autonomy and precision. The future of non-conventional robotics in the food industry looks promising. Innovations such as swarm robotics, where multiple robots work together in a coordinated manner and advancements in AI and machine learning will further enhance the capabilities of these technologies. These developments will enable the food industry to address emerging challenges, such as labor shortages and the need for sustainable practices, ensuring a resilient and efficient food supply chain.

Non-conventional robotics technology is reshaping the food industry, offering innovative solutions to longstanding challenges. From precision agriculture and harvesting to food processing, quality control, and delivery, these advanced systems enhance efficiency, safety, and sustainability. While there are challenges to overcome, the ongoing evolution of robotics technology promises a future where the food industry is more resilient, adaptive, and capable of meeting the demands of a growing global population.