APPLICATION OF ROBOTS IN FOOD INDUSTRY

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Abstract: *Aim of this research paper is overview of application of robots in food industry, how and where are they used, and why would they be good match or needed in food industry.*

Keywords: *Robots, food industry, manufacturing, collaborative robots, robots in retail, robots in dairy industry.*

1 Introduction

Food manufacturing industry is one of the largest manufacturing sectors in Europe, and its vital element for all national economies, it represents 13% of all manufacturing in EU.[5] Fast advance in various technological domains during last decade or two have made it possible to use robots for mostly anything included in food industry. Food manufacturing and processing factories are now using automation solutions, which are more effective in production volume, as well in cost efficiencies in compare with conventional processes. In industry its normal to be relied on manual labor, but lately it was shown that using robotic solutions for such jobs is far more effective, so for jobs like picking, packaging, placing, is far more effective to use robots instead of manual workers. In food industry was recorded an increase of +25% in efficiency, after employing robotics as compared to work done by human employees.[7] But it is not without its own problems, for example the processing of perishable food is strictly regulated by legislation, to reduce risk of contamination in production. Hygiene is a big obstacle as well, it has to constantly fulfill increasing demands for the protection of the customer.[8]

2 Robots in food industry

The use of robots in food industry has revolutionized production processes and increased efficiency and safety standards. Hygiene and the possibility of easy cleaning are mandatory in the food industry and current robots are designed to meet this requirements, and can withstand a complete wash down for use in the high care areas in food industry. The food processing and packaging sectors are using robots the most, palletizing, packing and picking are most popular applications for robots in food industry. They typically involve two-axis, four-axis and six-axis palletizing and handling robots. These are conventional robot applications which are similar to other applications in industries but hygienic design and high operation speeds are critical points in food industry and reason why several robot manufacturers have started producing robots specifically for this market. But also there are more specialized robots for different uses which were specially made just for its own purpose.[3][10]

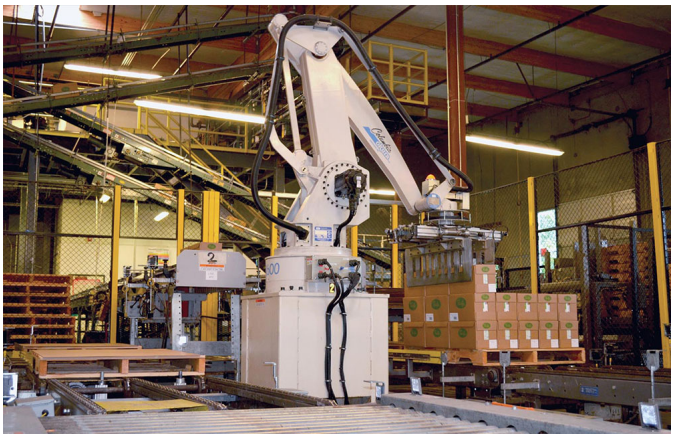

Figure 1: Palletizing robot

2.1 Food packaging and processing

All kind of products are handled by robots, from unpacked food products to the boxes of packaged goods, to trays and bottles of beverage, Robots work faster and more consistently than human workers, which is improving production efficiency, they also work without a need of brakes and work around a clock. Which increases production rates and reduces lead times. Robots are accurate and can perform tasks with consistent precision, what helps in reducing errors in packaging and processing of food, and there for reduces overall waste. Also working in dangerous or unpleasant surroundings for humans doesn't have a effect on robot what was designed for such conditions. And quality control is also big point in using robots for processing and packaging, robot can be used to inspect food products for defects or contamination in far higher speeds and accuracy than human workers, what again increases quality and efficiency overall. In food processing its possible to use robots for specifics tasks like cooking dishes or preparing sandwiches. Special product manipulators are made for such tasks, possibilities are almost limitless and can be applied in manufacturing, in homes, restaurants etc. In figure 2. can be seen a robot made for special purpose of assembling lasagna what would be problematic task for normal manipulators, but this prototype shows that even tasks what needs precision and have high chances of damaging the product can be done with enough thought in design.[3][6][5]

Figure 2: Robot for picking and placing pasta sheets[6]

2.2 Collaborative robots

Widely spreaded collaborative robots, also called co-bots. With co-bots is provided new opportunities for productions where presence of the operator cannot be avoided but lot of the operations are repetitive and can be performed by automated manipulators. Especially in food industry there are lots of such jobs so usage of co-bots is widely applicable. Lately more manufacturers designer facility layouts around such co-bots, and are investing more and more into them. The analysis of the economies shows that this investment in co-bots and investment in layout will likely return to the manufacturer who chooses to apply them. Its due to reducing the ergonomic load of the operator, and reducing the labor idle time, there for even the operators can work more efficiently with co-bots as a coworker, and its less likely that a bottleneck will occur at the end-of-the-line area.[1]

Figure 3: Collaborative robot

2.3 Harvesting robots for high value crops

High value crops are considered crops witch need a high labor input, generally non-stable crops as fruits, vegetables, spices, etc. Harvesting of such crops is performed multiple times during a production and its great candidate for automation. To automate harvesting, robots have been developed for last three decades, we are at the point where robots can automatically harvest crops in certain conditions, but for now they are still far from being perfect, so most of the harvesting is still being done manually due to the limited performance of current robots. But if conditions are met harvesting robots already exist and can be used. If robots are used for this purpose, biggest one of many challenges is harvesting crops without damaging and detecting where it is. Because of this reasons special grippers were designed specifically for this purpose, with hygienic design and flexible possibilities in handling various food products.[2]

Figure 4: Robot for harvesting tomatoes

2.4 Robots in Dairy industry

Robots were also present in dairy production for some time. Like most of the agriculture this branch is highly automatised with robots specially designed for this purpose. For example automatic milking systems or milking robots, which are most spreaded applications of robots in dairy industry. Robotic milking is voluntary milking system, it allows cows to choose when to be milked, this of course needs some training period for the animals but once its done, there is minimal need for human interaction with the process. At the end of the milking process, quality of the milk is tested, which increases quality control overall and increases access to the data for each individual cow. Robots are also used for cheese packaging, slicing etc. In cheese production robots do everything from stirring curds to portioning and packaging. Applying robots in this field made production skyrocket and robots are found to be more hygienic than manual workers. [7][9]

Figure 5: Automatic milking system

2.5 Robots in retail

Robot manufacturers have noticed that in the food and drink retail sector, is possibility and opportunity to implement robots, some of the retail jobs in food industry are based on some formula, like recipe for cooking and preparing drinks where robots can be well applied. Today the market is still in early stage in automating retail, but some of robots have appeared in the industry. For example Motoman's "RoboBar" is fully robotic bar that is able to prepare multiple alcoholic and nonalcoholic drinks and is used in Dubai where it is installed in a futuristic office building and in the Harrods Department Store in London. There are more and more robots used even in the shops, where robots not only can help with customer service but can also automatically analyse and report the state of available merchandise and help with stores restocking and orderings. In restaurants for instance robots can be used pretty much for everything, from cleaning the floors, to serving the customers and even preparing the food, and of course delivery for the takeouts is also possible and already applicable in multiple forms, for example, delivery by drones or even ground delivery robots. This system are not yet spreaded in wide use, but some companies are using them and getting positive results.[3][4]

Figure 6: Motoman's "RoboBar" [3]

3 Future of the food industry

Food manufacturing is by its nature highly diverse, and as long as customers are humans it will probably stay that way. Manual work will most likely remain, to satisfy local markets, but it will be combined with automation. However the large scale productions will be highly automated, with the upcoming of the fully automated plant, which will bring more flexible production and overall higher efficiency. The automation industry has now huge role to play, with providing the technology that will make it possible to achieve, and most importantly ensure that food industry sector continues to meet the demands for high quality, affordable products, and ever rising demand of food products. Luckily the manufactures of robots are not been slow to follow the demands made by increase in automation in food industry and many of them already is developing products to use the potential in this field. [5]

4 Conclusion

This paper had offered a brief overview of the application of robots in food industry, main advantage of robots in this field is over all higher accuracy, speed, and consistency, as well as possibility to work around the clock and consequently increasing efficiency and standards, as well as lowering the waste and time and human resources needed to realise demand for food. As for processes that involve animals as far as I could gather information, it seems that animal not only don't mind robots being used on them or for them, but they even like them in some regards, so there is not need to worry about animal cruelty. I think its great way to use robots, not just because of higher quality, but because it makes possible for improvement in food industry for future where is food demand going to be higher.

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Figure 1 accessed from: www.automationworld.com
Figure 3 accessed from: www.soltec.bg
Figure 4 accessed from: www.builtin.com
Figure 5 accessed from: www.morningagclips.com