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30 years of meat robotics: Opportunities and challenges (#44)

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Short Abstract

In the 1970's and early 1980's, research in robotics had significant focus on the automotive and conventional manufacturing industries. New initiatives considering applications for processing and handling of flexible products including food and meat began to receive attention in the late 1980's. The motivations were efficiency, productivity and quality control, as well as better utilisation of plant and materials. These remain and continue to be the focus for the production industries, including the meat sector. Today, the meat industry requires significant advances in knowledge and technology development, automating the basic tasks of cutting and handling. Integration of sensors with robots and advance software for control and execution of tasks has been possible. Examples include meat cutting and packaging, with one of the earliest examples being the deboning of beef forequarters[1, 2] in 1989. Figure 1 shows the basic approach integrating standard industrial robots with computer vision and force control for meat cutting.

More recently, a similar approach is being applied to the de-boning of lamb shoulder[3] under an Australian Meat Processor Corporation project. Several of the basic technologies are now cheaper and standard as modules, making the application affordable and capable of sustainable daily use in the meat processing environment.

Meat cutting solutions by robotics with generic applicability require technological solutions that combine the sensory capabilities as well as manipulation and motion control dexterities skills workers possess. Figure 2 provides an overview of the sensory, motion control and decision processing attributes that a robotic system must possess for tasks such as meat cutting and packaging.

It is relevant to highlight that enhanced capabilities in robotics, beyond human skill, may be reached with sensors that measure weight or scan products by x-ray, ultrasound or other similar devices. An example is the use of ultrasonic measurements in the determination of meat thickness in a fat trimming project, to leave a uniform layer of fat cover on a beef striploin[4].

Developments since the late 1980's have established new knowledge and practical application in meat cutting and handling relevant to primal cutting as well as de-boning and packaging. Figure 3 represents three important highly yield driven tasks for robots, where greater control over the process can result in significant performance in achieving consistent weights in higher priced primal products such as in lamb, pork and poultry.

The key is the computerised determination of cut paths[5] and the execution of the cuts in a manner that may be controlled, placing each cut on a carcass of varying size and shape, compared to a previous carcass. The outcome from each cut needs to be optimised without compromising quality or specification.

Although many challenges have been and continue to be met by advances in technology, opportunities for future applications, including those in beef and other protein and non-protein foods remain, including intelligent packaging[6].

The topics of this paper include past and on-going developments, drawing attention to the opportunities and challenges in technology advancements, approach to R&D, education and management of change, as well as exchanges through networking[7]. Focused action is required by all concerned before the wide-spread and sustainable use of robotics in the meat, and indeed the whole of food sector can be realised.

It is essential that all solutions for adoption are cost engineered and capable of day to day operation within the skill base of the user industries, with technology R&D providing simple and easily maintainable solutions.

References

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Notes

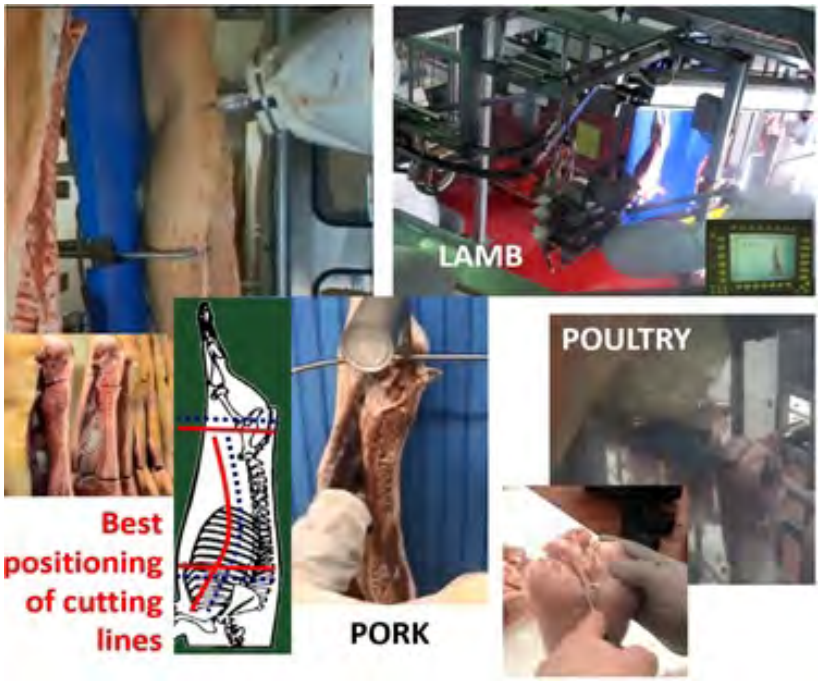

Figure 3

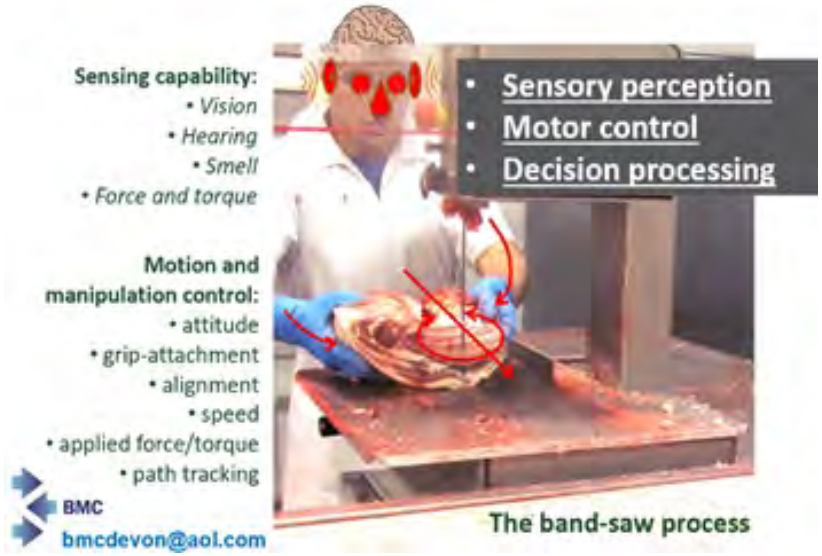

Figure 2

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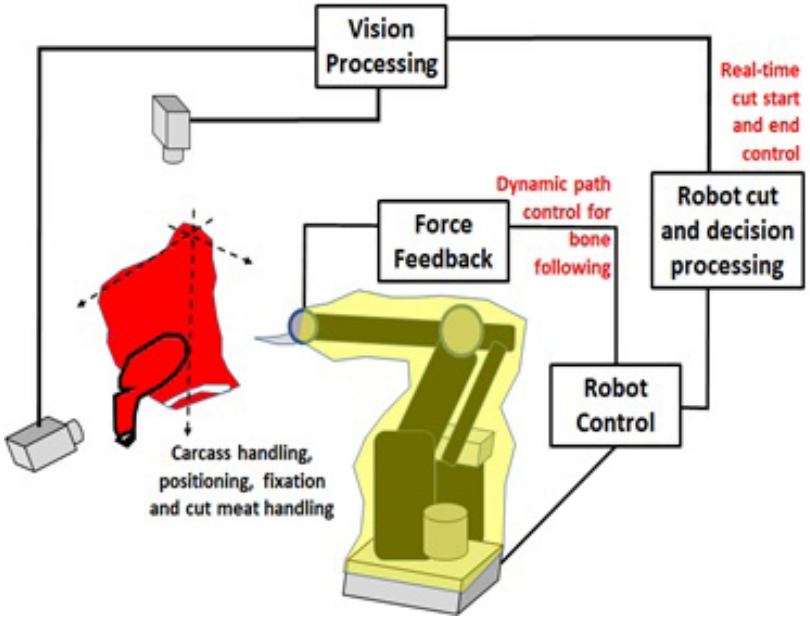

Figure 1

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