FIRST FEASIBILITY OF SHOULDER DE-BONING

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Project Description

The meat industry has a major requirement to automate its processes of slaughtering and meat preparation including primal cutting, sub-primal breakup and de-boning.

This project was proposed in 2016 to carry out a feasibility of de-boning lamb shoulder primal pieces, following discussions and the declared need by several Australian meat processors. In particular, the separation of the rib cage was to be evaluated and a solution for implementation as a prototype intended. The original approach considered similar steps to that applied by BMC (Koorosh Khodabandehloo) for the ATTEC Shoulder cutting to produce bone-in square cut pieces.

Project Content

The specific tasks included the assessment of shoulder primal variability in relation to de-boning as intended for automation. Cutting trials and generation of a blueprint of the solution has been intended and reached through the milestones of the project, which also included practical trials. This report provides results with an estimation of the cost for a twin robot solution that minimises the use of dedicated mechanisms and automation, whilst accommodation variability.

Project Outcome
The main variability in dimensions influencing the deboning steps include:

/   The overall width which varies by 40 mm about the main axis of the spine, with minimum width being 210mm and maximum 290 mm,

/   The overall length ranging 135 mm to 230 mm,

/   Effective height excluding neck section ranging 265 mm to 335.

The method of deboning by hand has two options with the neck removed by band-saw before deboning or the neck left on.

The process steps to separate the rib cage involves the following actions:

/ Separation of shoulder muscle from the spine featherbone by performing two knife incisions one on each side of the featherbone along the back of the shoulder.

/ Separation of the foreleg and shoulder muscle from one side of the rib cage and then the other side of the rib cage (see image).

/ The foreleg-shoulder pieces (the banjo) are then de-boned further by removing the leg bone and the shoulder blade, leaving the bone in shank intact and remaining attached.
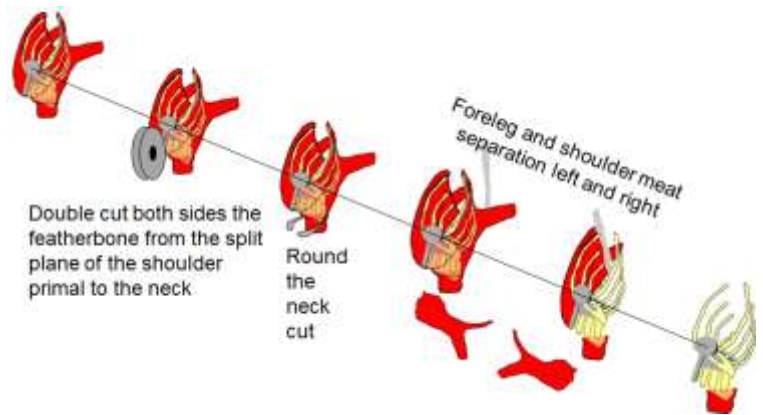
The approach to using automation would remove 30%-40% of the whole manual processing time, when focusing on the separation of the shoulder rib cage.

Trials and observations of the processes have been conducted and two practical options have documented that represent the manual process.

a) Separation of meat in the whole shoulder, neck and leg or the "banjo" as one piece, from the shoulder carcass, leaving behind the shoulder carcass, with the neck attached,

b) Separation of the banjo from the shoulder leaving behind the neck and shoulder muscles for the production of shoulder cutlets.

Assessments of the cutting schemes with cutting tool possibilities has been made and a robotic approach is identified as a solution for further examination.

The arrangements for a robotic solution has been sketched forming the bases for detailed evaluation and development which is to be supported by further trials and generation of a blueprint drawing of the solution.

Double cut both sides the featherbone from the split plane of the shoulder primal to the neck

Round the neck cut

Foreleg and shoulder meat separation left and right

The Figure provides the overview of the automated steps and the blueprint of the proposed Twin Robot Cell for lamb shoulder de-boning. A fixation solution is required for handling.
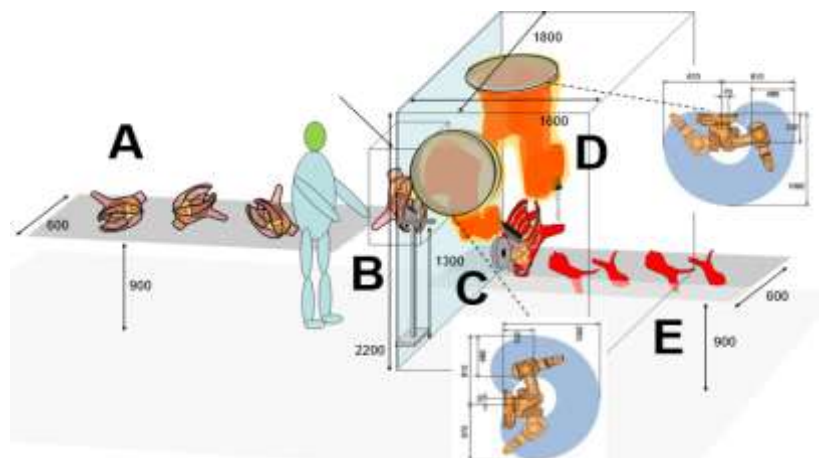
Benefit for Industry

The cost commercial cost of such a system is estimated at AU$ 273,900.00 and based on an overall labour saving of 2 people the ROI is calculated at 23 months over one shift, given a ribcage separation throughput, equivalent to 300 pieces per hour.

USEFUL RESOURCES

http://scott.co.nz/meat-processing/lamb/automated-boning-room-

https://www.cambridge.org/core/journals/robotica/article/robot-deboning-for-beef-forequarters/C08514A1D04A03A0921FE3A75BBAAAC1

http://www.atiia.com/Products/ft/sensors.aspx?gclid=CJTu7P2Mp9MCFYZjvAodAywHpA