Snapshot Report

In plant trial of robotic picking and packing system

Strategic Engineering Pty Ltd

Project Code	Prepared by	Date Submitted
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Project Description

The scope of this project is to take the Robotic Picking and Packing System as developed in the previous project (AMPC Project 2017-1065) and integrate, install and perform a successful trial of the system on real product in an operating meat processing plant. The host plant selected for the trial is JBS Australia – Brooklyn plant. Modifications to the system as it was during the previous in-house trial are required to allow operation and integration with the host plant. These included the addition of safety guarding and light curtains as well as design and manufacture of a new vision frame and outfeed area to meet the hygiene requirements of the plant. The robotic system will work alongside human packers and be responsible for identifying and packing only a subset of primal cuts.

Project Content

The plant layout provided by JBS Brooklyn as well as onsite measurements were used to develop a 3D model of the relevant conveyor system and nearby plant equipment. This influenced the designs for the robot base, encoder, trigger, vision frame, control cabinet and outfeed carton fixture. Relevant designs and modifications were manufactured, assembled and tested in house prior to transporting all the equipment to site. Following the installation of the system components into the plant commissioning of the system was conducted. This involved testing and verifying all the individual components following power on, checking communication as well as integration of the components together, and ultimately testing of the complete system.

Initial tests of the complete system in operation were conducted solely by Strategic Engineering staff. JBS operators and maintenance staff were then trained in the necessary operation of the system over a series of days, following which handover of the system was completed. The system was left with JBS personnel to conduct the in-plant trial. Overall these initial trials were successful, but had a lot of disadvantages for the host plant. Primarily, the requirement of a full time operator increased the total labour of the packaging area or took that personnel from their existing place in the packaging line

Modifications to the control system were planned to increase the overall production efficiency for the site. This involved developing an automatic identification algorithm for one type of primal cut with sufficient accuracy to allow the system to operate automatically without an operator permanently at the screen. Modifications to the robot program, vision application and communication between the two was made to facilitate the automatic identification of primal cuts. These changes were tested by Strategic Engineering staff and then handed over again to JBS operators. With this modified system, JBS are planning run an extended trial over approximately 2 months.

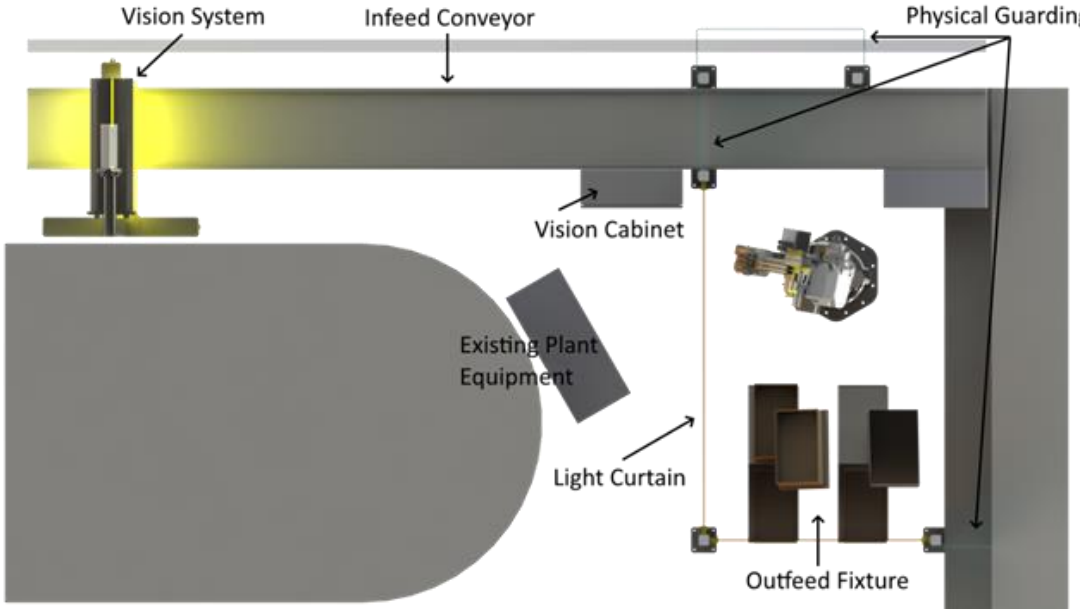

Figure 1: Robotic Picking and Packing Cell Layout Rendering.

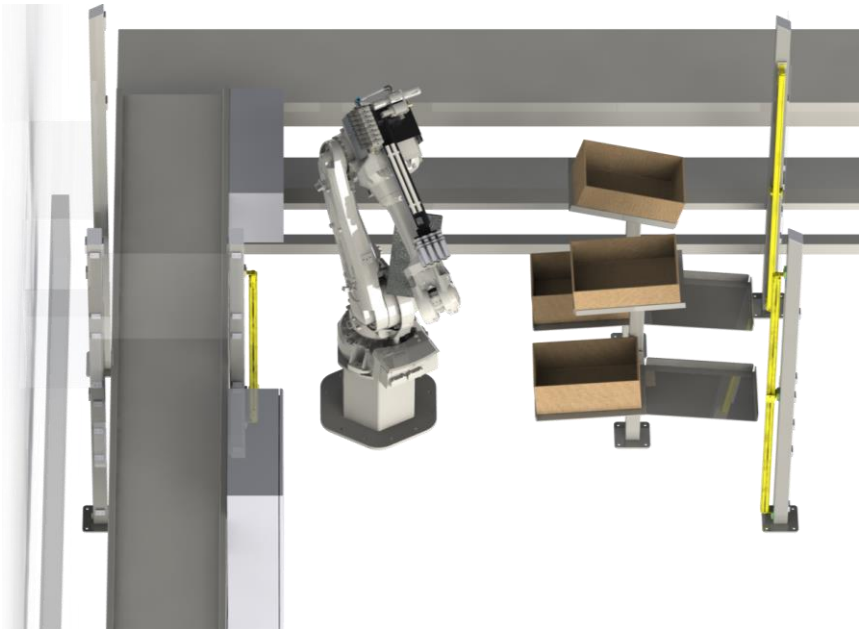

Figure 2: Robotic Picking and Packing Cell Layout Rendering

Project Outcome

Successful in-plant trials of the automated picking and packing system were performed in JBS Brooklyn plant. Packing was tested on a number of different primal cuts to find the optimal packaging strategy for the site. Initially, 4 different cuts were trialled, similar to the setup for the previous in-house trial. To maximise the efficiency of the robot cycle the system was trialled for two weeks packing just two type of primal cuts, the navel end brisket and the point end brisket, packing two cartons each per complete cycle. These two cuts were chosen because they were generally the largest and heaviest primal cuts on this particular conveyor line, as well as being easy for the operator to identify.

During the trial these primal cuts were successfully picked and packed into their respective cartons when correctly identified by the operator. The system was able to account for any primal cut orientation with respect to the conveyor by orientating the gripper during the pick sequence so it would align with the gripper ready to be packed into cartons. Following further discussion with AMPC and JBS, software modifications were made to automate the identification of one primal cut as a starting point to increasing the effectiveness of the system and ultimately fully automate the complete process. Following the implementation of these software changes and some refinement of the identification algorithm, successful identification of the navel end brisket was demonstrated with at least 90% accuracy with no false positives. Extended trials of the robotic picking and packing system with automatic primal cut identification are still ongoing with very positive results.

Figure 4: Robotic Picking and Packing Cell operating in-plant at JBS Brooklyn.

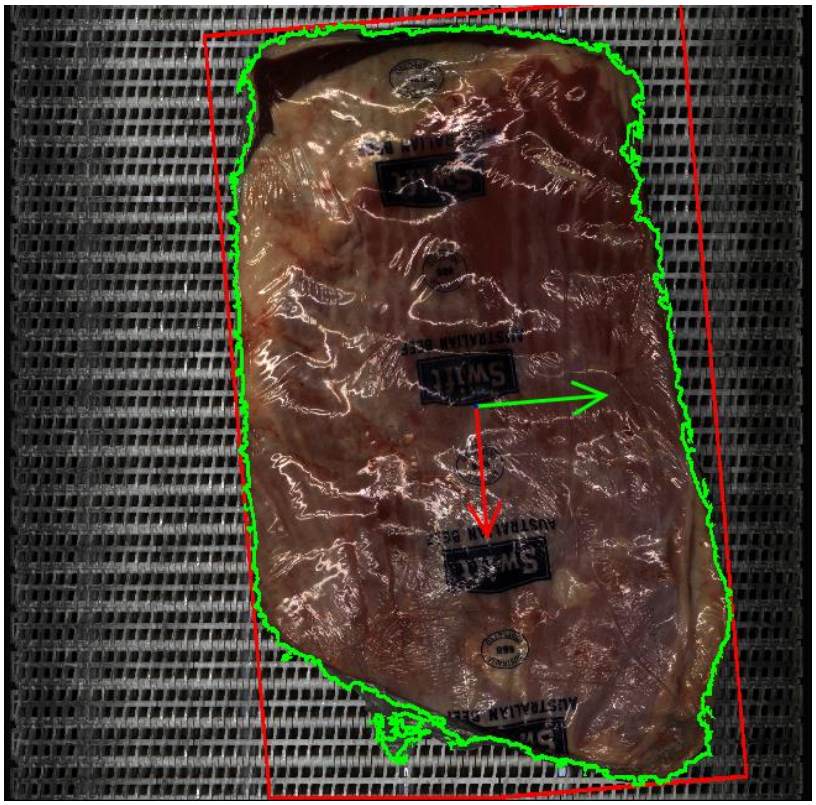

Figure 3: Processed Recitified image with region of the found primal cut (green outline), bounding box (red rectangle), pick position and rotation identified by coordinate arrows.

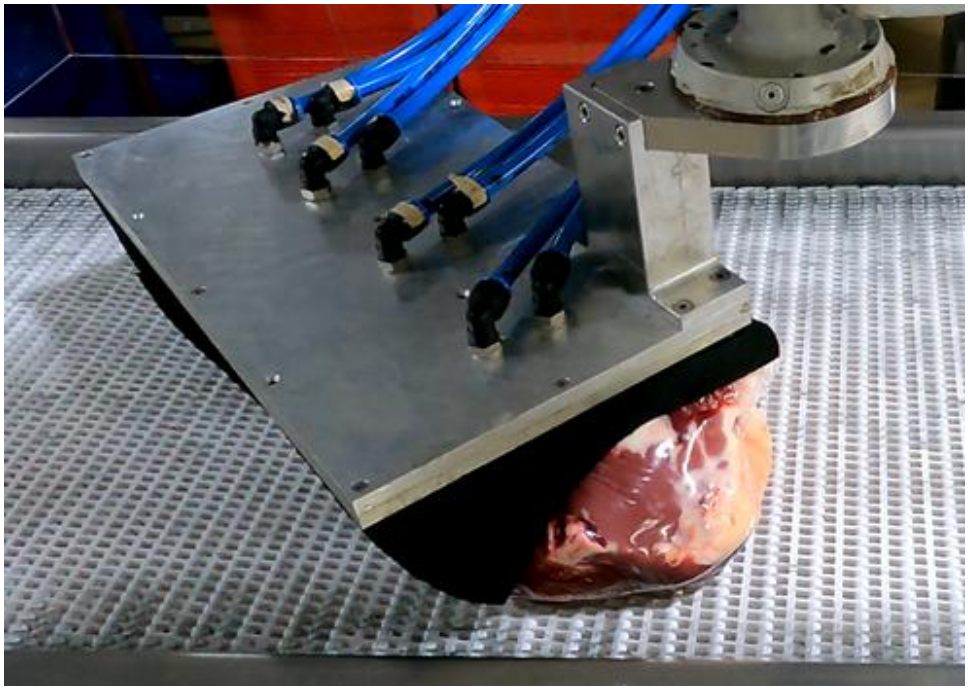

Figure 6: Robot picking showing rotation based on primal cut angle relative to conveyor.

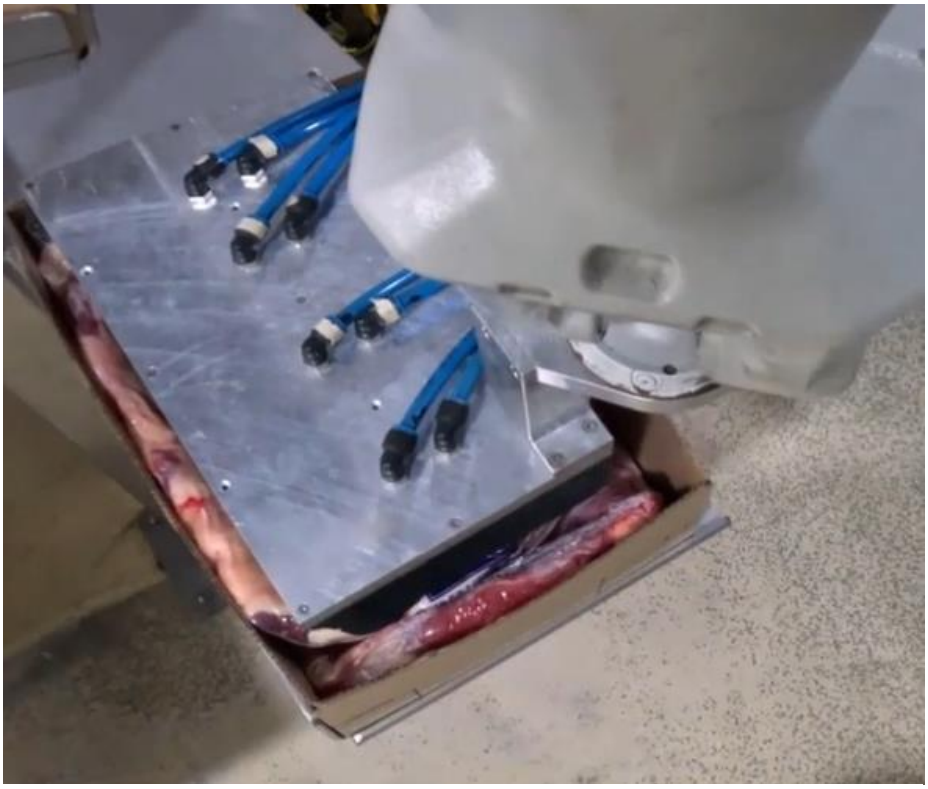

Figure 5: Robot flat packing to lower carton location

Benefit for Industry

Through this project an automated robotic cell capable of efficiently picking and packing primal cuts without the need for manual intervention was developed and demonstrated to perform effectively. If fully commercialised, the system could feasibly replace a number of labour units with a single robotic cell. No changes to existing packing conventions would be required due to the system's ability to emulate existing commercial packing configurations. This technology will pave the way to more comprehensive automation of the picking and packing area. Additionally, multiple robots may be used to accommodate a wider range of primal cuts and increase pick and pack speeds if desired. It's envisaged that plants would be able to add modular robotic picking and packing cells one by one as the technology develops and processors become more confident in the technology. In the foreseeable future, plants will have the potential automate the picking and packing of around 70% of primal cuts using this system, leaving 30% to humans, achieving automation whilst maintaining a degree of flexibility.

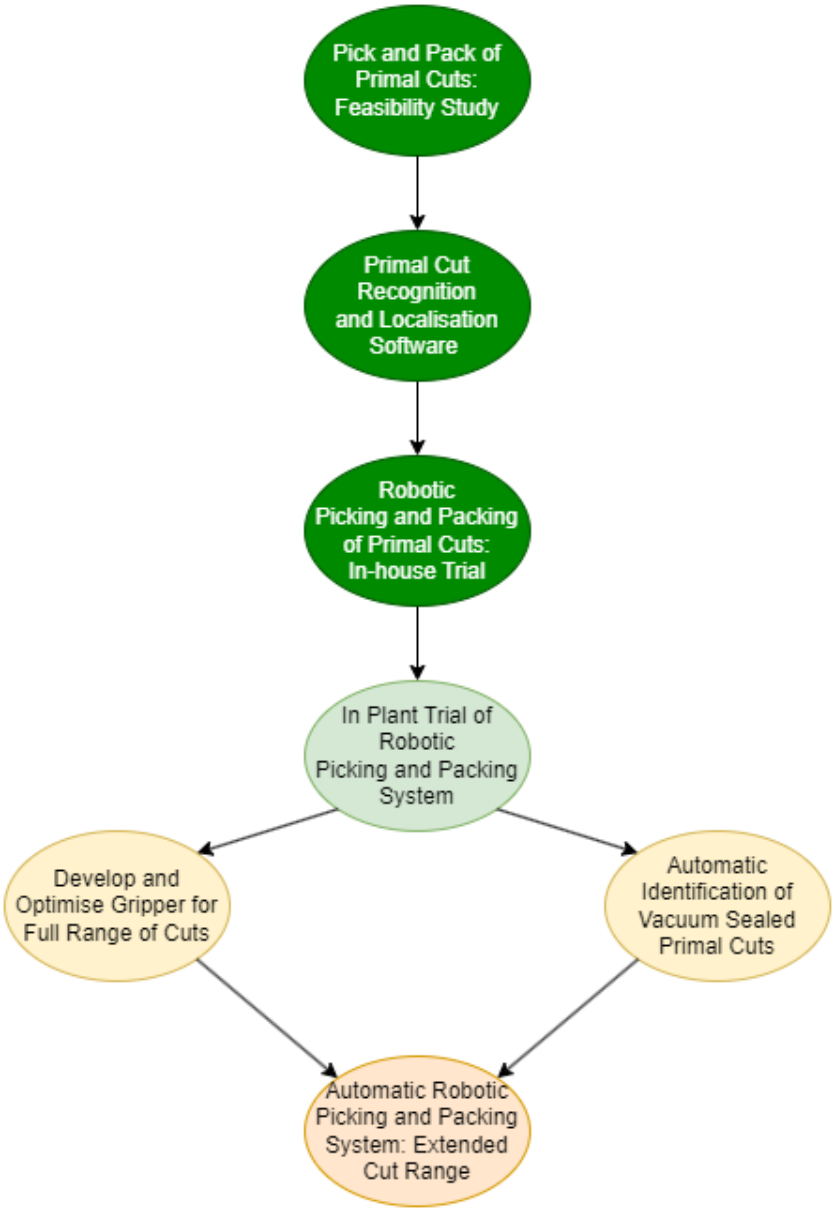

Figure 7: Current and Future Project Flowchart.