Snapshot Report

Remote Operations (Shadow Robots) – Stage 1

Snapshot

Project Code
2021-1193

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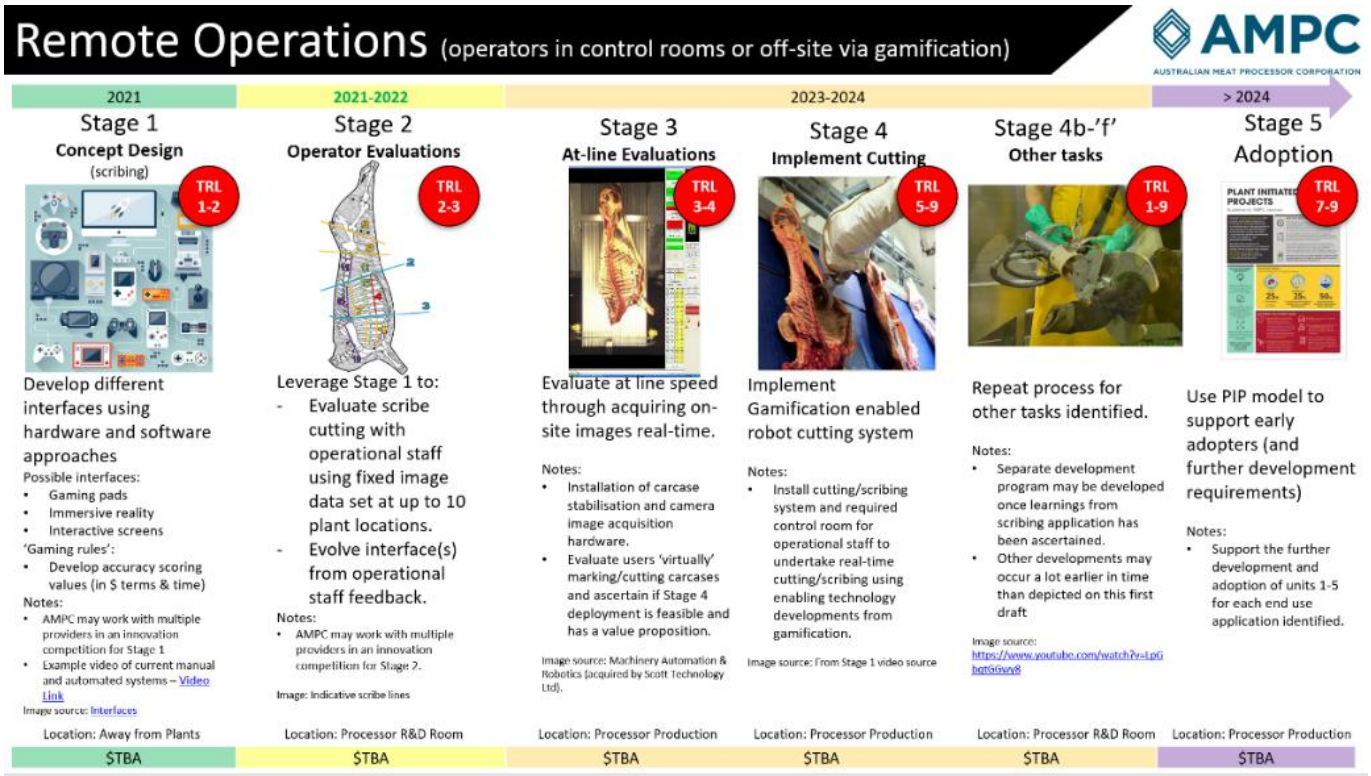
Project Description

AMPC (and the industry) have an innovation vision, and support R&D program, to eliminate all WHS incidents from processing operations. Where possible dangerous tasks will be fully automated. Where automation is not currently viable (either due to technology limitations or ROI), semi-automated/remote solutions will be developed that will remove the operator from dangerous tools and implements. Where semi-automated solutions are not viable then the remaining hands-on tools will be made as safe as possible (i.e. BladeStop and Guardian).

An Innovation Theme on a Page (ToaP) has been developed for this program of work and shows both the proposed development stages of the area. At the conclusion of all development stages, Australian beef processing facilities can aim to have operational staff undertaking certain processing tasks using a type of shadow robot concept. The operator may be in the processing room, e.g. at-line or in a control room, whilst eliminating potential for injuries. Other focus areas for desired achievement include: (1) provide a wider pool of staff suitable for the task, and or, a role for light duty staff, and or, staff with less mobility, (2) evaluate if the task can be performed remote from site, (3) using vision systems place virtual marks on the meat part to be cut to guide cutting the meat part to the required specification, and (4) using visions systems or AI ascertain the accuracy of the operator performing the activity for both training and different remuneration considerations. This project is focused on Stage 1 development scope only.



Project Content

The project methodology for the project was as follows:

1) Concept design and part selection (Milestones 1 & 2)
2) Purchase parts and modification to any purchased parts (Milestones 2 & 3)
3) Assemble proof of concept system in the factory (Milestone 3)
4) Testing, evolving system (using action learning cycle). (Milestone 4).
5) Successful demonstration to AMPC staff (Milestone 5).

Project Outcome

When initially embarking upon the technology assessment journey for shadow robotics in the meat industry, Intelligent Robotics examined a number of possible technological approaches. These were assessed against the potential red meat industry use cases for shadow technology. IR took the specific path of seeking to use the technology for the purposes of driving (semi)automation, as opposed to focussing on potential training applications.

In considering all the relevant factors when assessing the technology available in this space, it was thought that the most promising technology to explore would be the Haptic Controller. It's a novel technology which, to the best of IR's knowledge at the commencement of its exploration, hadn't yet been explored in Australian for the red meat industry, and seemed to fit the key value drivers. Its use-cases could include any task requiring "grasping" of a knife or tool, and requiring some form of force feedback to the operator during operation. It could also be used to take advantage of the force multiplication advantage of robots. As a starting point, the technology could be evaluated at-line to understand the technology itself, before progressing to being operated in a more remote environment such as in front of screens or through VR. As a new, "blue-sky" technology, the task was to understand where the limitations currently lay against the goals for the technology for the red meat industry.

A number of use-cases were considered/examined throughout the course of the project:

1) Hindquarter deboning (split into "hooking and pulling" and "cutting" operations)
2) Meat inspection (involving placing a camera on the end of the robot, with an operator in front of a screen, to perform a meat inspection task)
3) Fat trimming (using the haptic controller to operate a robot holding a Whiz-trim knife to perform fat removal)
4) Scribe line marking (using the haptic controller to operator a robot holding two marking tools to mark the rib cut placement across a rib cage)

The final milestone of the project saw the demonstration of the technology to AMPC. The assessment from this demonstration was that the technology is currently sitting at a Technology Readiness Level of 3 or 4 relative to red meat plant readiness. AMPC were able to quickly come up to speed with using the device, and were able to successfully control the Whiztrim knife mounted to the robot to perform fat trimming passes on a beef brisket primal. However, the usability and finesse of the technology was still an area that needed significant improvement before being ready for a plant environment. It was acknowledged that further training and practice with the device would improve this, but not to the extent necessary with the technology in its current form. Intelligent Robotics agrees with this assessment and, while it was hoped the technology was further advanced, this was a journey that was required to be able to assess this firsthand.

A more feasible contender in the space of shadow robotics may be through a semi-automated user interface, requiring the operator to observe and click "key points" on a screen to drive robotics. That said, there are still use-cases where the "point-and-click" method may be too simple to adequately direct robotics, particularly in instances where an element of "feel" is required. In these areas, the haptic controller may still be the most promising for achieving remote operation. However the technology needs to improve significantly in terms of its usability and control to become viable for plant use.

Work is ongoing with the manufacturer, including integrating the controller with larger, industrial hygienic robots. This will enable the technology to be fit-for-purpose in terms of environmental requirements in an abattoir, while also unlocking greater force multiplication benefits. The feedback of a robot rollface load cell into the control algorithms may also improve the usability of the technology, which will be critical for progressing it further into the industry.

Benefit for Industry

The outcome of Stage 1 of Shadow Robots is to demonstrate that Tele-remote Operated Robots are a viable technology for the processing sector to consider developing. The result of Stage 5 of the Remote Operation Pathway will aim to have a range of different Tele-remote Operated Robot systems, performing a range of different tasks adopted and installed in multiple sites across Australia.

There are a range of benefits behind the use of Tele-remote Operated Robots that is inline within AMPC's 2020-2025 Strategic plan, including:

1) Removing staff from dangerous operations, via hands-off processing.
2) Increasing safety and wellbeing, by reducing the high-risk nature or certain processing operations.
3) Attraction of people to the industry via demonstrating a wide range of technological operations.
4) Retention of people within the industry by improving working conditions.
5) Development, via developing tasks that require higher skills and intellect.
6) Increasing carcase primal profitability through optimisation
7) Enabler for acquiring product and processing formation in order to leverage data insights.

Stage 1 of Shadow Robots will allow for the evaluation of tele-remote operated robot use cases, with the aim to have one use to develop and deploy within industry in the short term.