

final report

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Beef Hock Cutter upgrade JBS Dinmore

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Abstract

The original camera system used on the Robotic Hock Cutter at JBS Dinmore has failed and is no longer supported by the manufacturer who has gone out of business. As a result MAR has replaced the camera system with a new system that is backed by Microsoft. In addition the PC as well as software and communication protocols have been upgraded installed and commissioned on site. The Robotic Hock Cutter system is running in production and is capable of achieving cut accuracy equivalent to the original system. It does suffer issues however due to the stabilisation of the carcass resulting from the increase speed of the line and location of the rub bars and stabilisation conveyor.

Executive Summary

The original camera system used on the Robotic Hock Cutter at JBS Dinmore has failed and is no longer supported by the manufacturer who has gone out of business. As a result MAR has replaced the camera system with a new system that is backed by Microsoft. In addition the PC as well as software and communication protocols have been upgraded installed and commissioned on site. The Robotic Hock Cutter system is running in production and is capable of achieving cut accuracy equivalent to the original system. It does suffer issues however due to the stabilisation of the carcass resulting from the increase speed of the line and location of the rub bars and stabilisation conveyor. MAR are in discussions with JBS on possible resolutions to these issues and plan to submit a proposal to MLA for support in making the modifications the system to bring the accuracy and consistence of cut back to what they were with the previous camera system and line speed.

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1 Background

Early in 2013 JBS Australia (Dinmore plant) reported issues with the beef hock cutting system not cutting correctly and an error from the vision software appearing on the screen.

MAR's QLD based service engineer Michael Lee attended site several times and isolated the issue to be within the TYZX sensing system card/software/camera.

Upon trying to contact the manufacturer of the TYZX camera system, it became apparent that TYZX no longer exist and no longer provide support for any of their products and systems. This was confirmed after eventually contacting a past employee at TYZX.

This situation was very unwelcome for both MAR and JBS, however the fact remained that the TYZX system could not be repaired or supported leaving us in the current situation. Attempts have also been made by MAR to repair the system but this was unsuccessful.

With the above knowledge MAR investigated possible solutions with other sensing equipment. MAR identified the Kinect camera system as the most viable solution which offered good potential and importantly, to avoid similar situations in the future, offered good long term support due to the fact that Kinect is a new development, widely used and is supported by a major organisation (Microsoft).

MAR then proceeded to perform a series of concept trials (MAR self-Funded) both on-site at JBS Dinmore and at MAR to establish suitability. This proved successful and provided insight as to what is required to overcome the current situation at JBS Dinmore and the Beef Hock Cutter System.

This upgrade work also provides the opportunity to replace/repair other minor items on the beef hock cutter system which after four years of production have indicated weakness and where improved solutions are now available.

2 Project Objectives

The objectives of the project are as follows:

- Replace the failed TYZX camera with Kinect camera.
- Provide and installation of all cabling, converters, new droppers, enclosures and brackets etc. to suit.
- Upgrade the current Vision Pro software, to Halcon and accommodate use of two new Kinect cameras and interface with existing thermal vision camera system still used and required.
- Re-locate hock cutter PC system to eliminate PC vibration experienced and replace with fixed PC suitable for new cameras and software. This will also avoid failure of similar key components which failed on the TYZX system.
- Upgrade and replace current DeviceNet communications used between the PLC and vision PC. Current system uses a Dnet card and is very difficult (long lead time) to obtain should a future failure occur which has happened previously. The DNet card and communications will be replaced with up to date Ethernet card and communications system now more commonly used in the industry.
- Upgrade pneumatic controls to utilise Ethernet communications.
- Installation, setup, testing and commissioning the above equipment to ensure Beef Hock Cutter system is back in full production.
- Detailed report to outline process, findings and resulting impact for future systems.

3 Methodology

The objectives will be achieved by completing the following milestones:

Milestone 1:

Procurement of Hardware

Milestone 2:

Installation, setup, testing and commissioning of new hardware and software.

Milestone 3:

Project report.

4 Results and Discussion

The following were purchased for the upgrade to the Robotic Beef Hock Cutting system at JBS Dinmore:

- Kinect Camera and associated cabling to replace the failed TYZX camera.
- Enclosure and brackets for housing the new Kinect camera.
- Halcon software and runtime dongle.
- PC, enclosure and associated hardware for mounting in the roof.
- Ethernet controlled pneumatic valving to replace existing as requested by JBS

The image below shows some of this equipment at MAR Sydney for programming prior to going to site. The remaining hardware was been delivered to MAR QLD for assembly and installation.



Fig. 1 Equipment at MAR Sydney for programming before going to site

The images below show the completed installation for the upgrade on site at JBS Dinmore. The new PC is mounted in the new panel in the ceiling space above the Hock Cutter robot and the new Kinect camera is mounted in the modified camera box on the production floor. Fig 4 shows the images being received from the camera.



Fig.2 New PC mounted in roof space

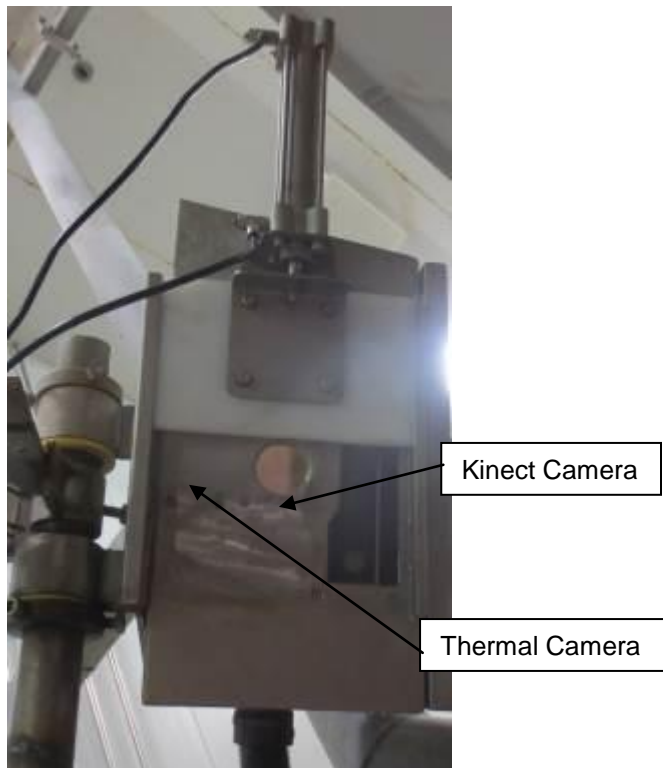


Fig.3 New Kinect camera mount with thermal camera on the production floor

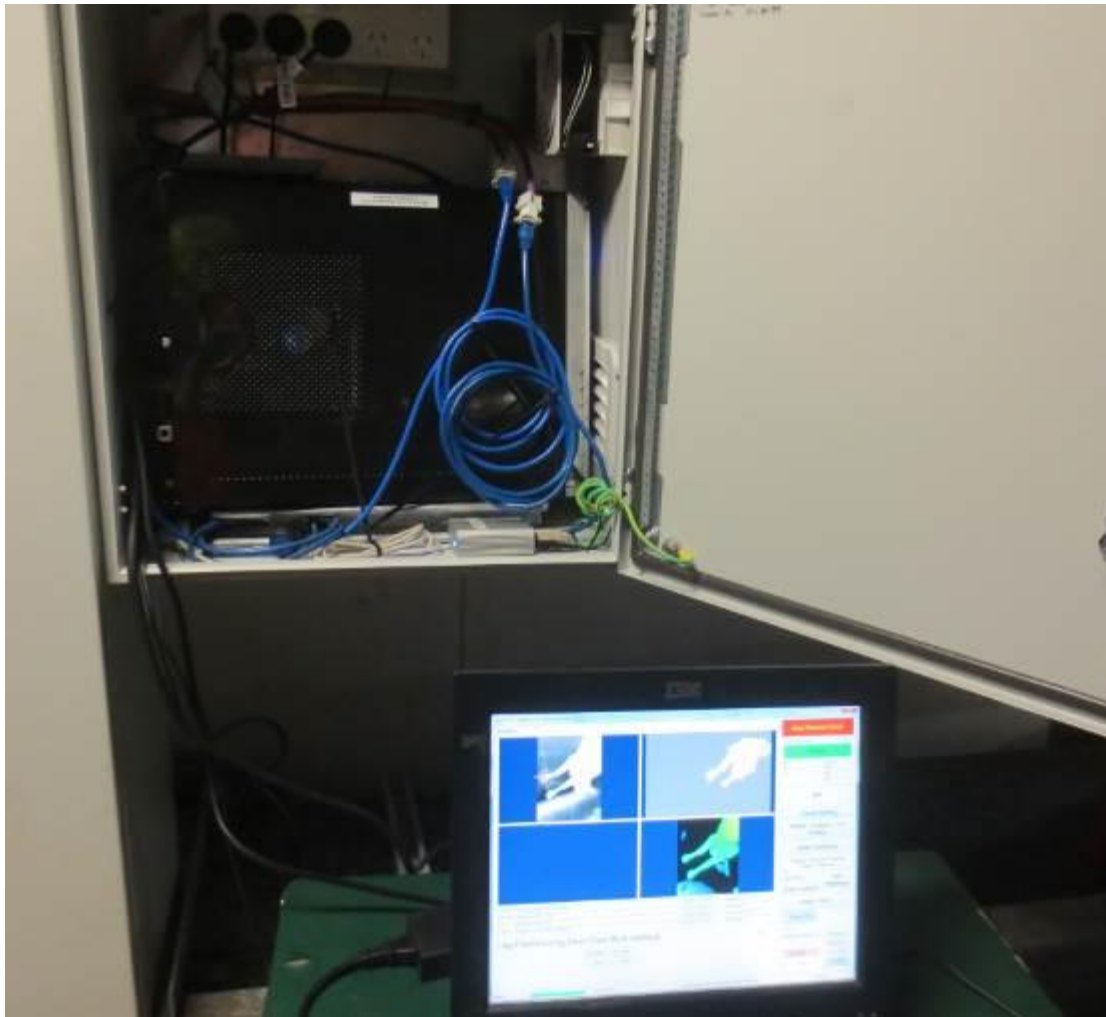


Fig.4 Images being received from New Kinect camera.

MAR commissioned the system in January 2014 achieving cut accuracy equivalent to that achieved with the previous camera system, providing that the carcasses were presented in an equivalent fashion, and have been supporting it in production since this point.

5 Success in Achieving Objectives

The objectives of the project have been achieved, namely;

- The TYZX has been replaced with a Kinect camera
- The PC has been upgraded to accommodate the upgraded Halcon vision software which has been installed and commissioned
- The PC has been relocated in the ceiling space
- The devicenet communications has been upgraded to Ethernet and the pneumatic valve bank upgrade to suit.
- The system has been commissioned, has been running in production and is capable of achieving cut accuracies equivalent to those achieved with the original system provided that carcasses are presented to the system in a stable fashion.

The issues that have been experienced since the commissioning of the new camera system centre around the stability of the carcass as it is presented to the system and hence the resulting cut accuracy.

The email below was sent by Theo Uhrle JBS Engineering Manager to MAR and JBS Plant Management in May 2014. It indicates an issue with the stabilisation of the carcass caused by the increase in speed of the line which is believed to be causing issues with the cut accuracy being achieved. MAR will work with JBS to propose a resolution to this issue.

Gents,

While we are still seeking some reliability with the new camera system I have had some discussions with the Mar engineers on site , Adrian and Roland and Warwick. One nagging problem seems to be with body rotation at the start of the blue conveyor and end of the existing rub rails.

It is clear that some bodies will rotate a little meaning the legs are not ending up where the cutter goes to.

While in the past it has been thought the conveyor was out of sync due to the encoder drive being insecure, now this has been running correctly this is not looking to be the only problem.

In one period I saw, wider bodies that were squeezed between the rub rails stayed relatively straight, whereas bodies that were smaller or thinner in that 'waist' area could move within the rails and rotated.

Also bodies drag and catch, then release and swing, and this causes excess movement or rotation as well. It is only a minor change but we now run the chain 2.9% faster than when the robot went in, with a squared energy increase 5.9%, being converted into pendulum effect gives a significant change in position at the legs.

I believe some work needs to be done to either extend the conveyor (or shift it further forward) and / or modify the rub rails. Initially maybe some movie footage should be taken so everyone can see the issues

This needs some group discussion

regards

Theo Uhrle

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6 Conclusions and Recommendations

It can be concluded that the camera upgrade to the Beef Hock Cutting system at JBS Dinmore was a success. However there are still issues with cut accuracy due to swing in the carcass induced by increased line speed and positioning of the rub rails and stabilisation conveyor. MAR will discuss with JBS a planned solution and may present MLA with a proposal to assist in modifying the setup of the carcass stabilisation for the system.